Published by
Faculty of Mathematics and Natural Sciences
Institut Teknologi Bandung

ISBN 978-602-74668-0-7

AMC 2016

THE ASIAN MATHEMATICAL CONFERENCE

Bali

Program & Abstracts

25 - 29 JULY 2016

Bali Nusa Dua Convention Center
Bali Indonesia

Hosted by:

IndoMS
Indonesian Mathematical Society

SEAMS
South East Asian Mathematical Society

ISBN 978-602-74668-0-7

The Asian Mathematical Conference 2016

Program

Abstracts

July 25 – 29, 2016
BNDCC Nusa Dua, Bali, Indonesia

Hosted by : IndoMS (Indonesian Mathematical Society)
SEAMS (Southeast Asian Mathematical Society)

Organized by : ITB (Institut Teknologi Bandung)
Unpad (Universitas Padjadjaran)
UGM (Universitas Gadjah Mada)
UI (Universitas Indonesia)
UNUD (Universitas Udayana)

Supported by : Ministry of Research, Technology and Higher Education, Indonesia
IMU - International Mathematical Union
KMS - Korean Mathematical Society
MSJ - Mathematical Society of Japan
KIAS - Korea Institute for Advanced Study
CIMPA – Centre International de Mathématiques Pures et Appliquées
Committee for Women in Mathematics
Ministry of Tourism Indonesia
PAI (Persatuan Aktuaris Indonesia)

Published by the Faculty of Mathematics and Natural Sciences, Institut Teknologi Bandung

The Asian Mathematical Conference 2016: Program & Abstracts

ISBN 978-602-74668-0-7

Editors:
Intan Muchtadi Alamsyah
Ikha Magdalena
Utriweni Mukhaiyar
Kristiana Wijaya
Gustina Elfiyanti
Aditya Purwa Santika
Dian Kastika Sofyan
Debi Oktia Haryeni
Yudi Mahatma
Bety Hayat Susanti
Susilawati
Edy Tri Baskoro

Published by:
Fakultas Matematika dan Ilmu Pengetahuan Alam
Institut Teknologi Bandung (ITB)

Gedung LabTek VIII Lantai 1
Jalan Ganesa 10 Bandung
Indonesia 40132
Phone: (022) 2515032, Fax: (022) 2502360
www.fmipa.itb.ac.id
email: admin@fmipa.itb.ac.id

Contents

A. Words of Welcome 2
B. Introduction of Plenary Speakers 5
C. Introduction of Special Lecture Speakers 15
D. Schedule 19
E. Program
Plenary Lectures 25
Special Lectures 27
Schedule of Sections S01 – S10 28

S01. Logic and Foundations / Mathematics Educations / History of Mathematics 28
S02. Algebra / Lie Theory and Generalizations, Number Theory 38
S03. Algebraic and Complex Geometry, Geometry 47
S04. Topology, Analysis and its Applications 50
S05. Dynamical Systems and Ordinary Differential Equations 56
S06. Partial Differential Equations 65
S07. Probability and Statistics 69
S08. Combinatorics and Graph Theory 85
S09. Mathematical Aspects of Computer Science, Numerical Analysis and Scientific Computing /Mathematics in Science and Technology 97
S10. Control Theory and Optimization 113

F. Special Activities 118
G. Abstract 121
H. Index of Authors 533
I. Other Information
Committees 555
Social Activities 560
Practical Information 561
Restaurants 564
Co-operating organizations, institutions, sponsor and donators 569
Exhibitions 570
Map of BNDCC

Words of Welcome

Edy Tri BASKORO
Chair of Asian Mathematical Conference (AMC) 2016

Budi Nurani RUCHJANA
President of Indonesian Mathematical Society

This wonderful opportunity has finally come to Indonesia. The spirit of Mathematics is in the air. We are very proud to be able to hold this big event in the place where everyone would love to visit, Bali. Please accept our warm greetings to all of you! It is our great honor and pleasure to welcome all the participants of the Asian Mathematical Conference 2016 from July 25 to July 29 to Bali, Indonesia.

As one of the most prestigious gatherings of mathematicians in Asia, the Asian Mathematical Conference (AMC) has been conducted since 1990. This AMC2016 is the seventh one and hosted by the Indonesian Mathematical Society (IndoMS) and South East Asian Mathematical Society (SEAMS). We are very happy to have this great opportunity to hold such important event. This conference surely will give a very significant impact on promoting and enhancing mathematics in Indonesia as well as in the Asia region.

The program of this conference consists of plenary talks, special lectures, invited and contributed talks as well as posters and exhibitions. We are very grateful that more than 600 mathematicians from 33 countries attend this conference. In this conference, we also have a forum on the establishment of the Mathematical Union of Asia as well as a forum on Asian Women Mathematicians.

We would like to express our sincere gratitude to all the speakers, members of the steering, scientific, program and organizing committees of the AMC 2016 and Indonesian Mathematical Society, SEAMS council members, and distinguished guests from all mathematical societies in Asia. Special thanks go to the co-organizers: Institut Teknologi Bandung (ITB), Universitas Padjadjaran (Unpad), Universitas Gadjah Mada (UGM), Universitas Indonesia (UI) and Universitas Udayana (Unud). We also thank the Korean Mathematical Society (KMS), Mathematical Society of Japan (MSJ), Korea Institute for Advanced Studies (KIAS), International Mathematical Union (IMU), Commission of Women in Mathematics IMU, Centre International de Mathematiques Pures et Appliquees (CIMPA), the Ministry of Research Technology and Higher Education, the Ministry of Tourism, Badan Keamanan Laut (BAKAMLA), Persatuan Aktuaria Indonesia (PAI), PT Komatsu Indonesia for their invaluable supports.

Once again, welcome all of you, we hope all of you enjoy staying in the paradise island of Bali, Indonesia.

Words of Welcome

LING San

President, Southeast Asian Mathematical Society

On behalf of the Southeast Asian Mathematical Society (SEAMS), I welcome you warmly to the Asian Mathematical Conference 2016 (AMC 2016).

The AMC was inaugurated in 1990 in Hong Kong. Held on the average of every 4-5 years, the AMC has been held subsequently in Thailand (Nakhon Ratchasima), the Philippines (Manila), Singapore, Malaysia (Kuala Lumpur), and South Korea (Busan). AMC 2016 is the seventh conference in this series. We thank our colleagues in the Indonesian mathematical community for hosting and organizing this important event at this beautiful location of Bali.

Asia is a vast continent with countries and regions at very different stages of development in mathematics. Some are mathematically very advanced, and have produced many a renowned mathematician; some face major challenges even to produce enough university graduates in mathematics. However, what is important is that progress is constantly being made throughout the continent in both research and education in mathematics.

With speakers and participants hailing from all over the world, the AMC is a good platform to showcase mathematical research in Asia, to celebrate the achievements of mathematicians in this continent, to facilitate networking for mathematicians from Asia and beyond, and to advance the cause of mathematics together.

I am glad that you have chosen to participate in AMC 2016. I wish you a fruitful and enjoyable time here in Bali, Indonesia.

James Maynard
Clay Research Fellowship

DPhil in Mathematics, Balliol College, Oxford "Topics in analytic number theory", supervised by Prof. Heath-Brown, 2009 - 2013.
Certificate of Advanced Study in Mathematics, Queens' College, Cambridge, Distinction, 2008 - 2009. BA Mathematics, First Class Honours, Queens' College, Cambridge, First Class in each year, 2005 - 2008.
Secondary Education, King Edward VI Grammar School, Chelmsford, 1998 - 2005.

He has received a number of awards, including LMS Whitehead prize in 2015, SASTRA Ramanujan prize in 2014, Featured in Bourbaki Séminaire 1084, "Gaps between prime numbers and primes in arithmetic progressions (after Y. Zhang and J. Maynard)" given by Prof. Kowalski in 2014, and Featured in AMS Current events bulletin "Infinitely many pairs of primes differ by no more than 70 million (and the bound's getting smaller every day)" given by Prof. Granville in 2014.

Small (and large) gaps between primes

Many of the most famous and most important questions on the distribution of primes can be cast as solving systems of linear equations with prime variables. The twin prime conjecture, Goldbach's conjecture, k-term arithmetic progressions of primes and most questions about small gaps between primes can all be seen in this manner, as well as several questions with applications to diophantine geometry or cryptography. We will describe some of the progress on these questions, with a particular emphasis on establishing weak forms of some of these questions which has led to new results on bounded gaps between primes and large gaps between primes, amongst other things.

Plenary Lecture - 1
Chair: Intan Muchtadi
10.30 - 11.30, July 26 (Tue), 2016
Room: Pecatu Hall 1 and 2

Sudhir Ramakant GHORPADE
Indian Institute of Technology, Bombay

B.Sc., University of Bombay, 1982.
M.Sc., Indian Institute of Technology, Bombay, 1984.
Ph.D., Purdue University, West Lafayette, USA, 1989.

He has received a number of awards and grants, including Silver Medal for the best performance in Mathematics, Master of Science, Indian Institute of Technology Bombay, 1984, TWAS Research Grant Award, Third World Academy of Sciences, Trieste, Italy, November 1993, research Fellowship from the Centre National de la Recherche Scientifique (CNRS) of France, June 1996, the AICTE Career Award for Young Teachers, All India Council for Technical Education New Delhi, January 1998, Otto Mønsted Professorship in the Department of Mathematics at the Technical University of Denmark, Lyngby, Denmark, May-July 2010, Elected Fellow, National Academy of Sciences, India, October 2010, IIT Bombay Research Paper Award for the year 2011 (for the paper (with G. Lachaud) "Etale cohomology, Lefschetz theorems and number of points of singular varieties over nite elds", Moscow Mathematical Journal Vol. 2, No. 3 (2002), pp. 589631), Industrial Research and Consultancy Centre, IIT Bombay, 2012, DST-RFBR Grant for the Indo-Russian project 'Algebraic varieties over finite fields and linear error correcting codes', Dept. of Science and Technology (Govt. of India) and Russian Foundation for Basic Research (Govt. of Russian Federation), 2012-2014, Prof. S.C. Bhattacharya Award for Excellence in Pure Sciences, Indian Institute of Technology Bombay, March 2014, twenty fifth V. Ramaswamy Aiyer Memorial Award Lecture, 80th Annual Conference of the Indian Mathematical Society, Dhanbad, December 27-30, 2014, Platinum Jubilee Lecture, Session on Mathematical Sciences, 102nd Indian Science Congress, University of Mumbai, Mumbai, January 3-7, 2015, twenty seventh Ramanujan Endowment Lecture, Anna University, Chennai, March 2016.

Number of zeros of multivariate polynomials over finite fields

A univariate polynomial of degree d with coefficient in a field $\mathbb{F}$ has at most d zeros in $\mathbb{F}$. Likewise, a bivariate homogeneous polynomial of degree d over $\mathbb{F}$ has at most d non-proportional zeros in $\mathbb{F}^2 \setminus \{(0,0)\}$ or in other words, at most d zeros in the projective space $\mathbb{P}^1(\mathbb{F})$. However, multivariate polynomials will, in general, have infinitely many zeros. But when $\mathbb{F}$ is the finite field $\mathbb{F}_q$ with q elements, it makes sense to ask for similar degree-based bounds on the number of zeros of one or more multivariate polynomials of

given degrees. We consider in particular, the following question. Let r, d, m be positive integers and let $S := \mathbb{F}_q[x_0, x_1, \ldots, x_m]$ denote the ring of polynomials in $m+1$ variables with coefficients in $\mathbb{F}_q$ and $\mathbb{P}^m = \mathbb{P}^m(\mathbb{F}_q)$ the m-dimensional projective space over $\mathbb{F}_q$.

Question: What is the maximum number, say $e_r(d, m)$, of common zeros that a system of r linearly independent homogeneous polynomials of degree d in S can have in $\mathbb{P}^m(\mathbb{F}_q)$?

A remarkable conjecture by Tsfasman and Boguslavsky made about two decades ago predicted an explicit and rather complicated formula for $e_r(d, m)$ at least when $d < q-1$. This was already known to be valid in the case $r = 1$, thanks to the results of Serre (1991) as well as Sørensen (1991), The conjectured formula for $e_r(d, m)$ was shown to be true in the case $r = 2$ by Boguslavsky (1997). In this talk, we will outline these developments and report on a recent progress in a joint work with Mrinmoy Datta where we show that the Tsfasman-Boguslavsky Conjecture holds in the affirmative if $r \leq m + 1$ and is false in general if $r > m + 1$. We will also mention some newer conjectures and results that are partly obtained in collaboration with Peter Beelen and Mrinmoy Datta.

Plenary Lecture - 2
Chair: Fidel Nemenzo
13.30 - 14.30, July 26 (Tue), 2016
Room: Pecatu Hall 1 and 2

Martin Hairer

The University of Warwick

PhD in Physics, University of Geneva, November 2001.
MSc in Physics, University of Geneva, October 1998.
BSc in Mathematics, University of Geneva, July 1998.

Regius Professor of Mathematics, University of Warwick since April 2014.
He has received a number of awards, including LMS Whitehead Prize in 2008, Philip Leverhulme Prize in 2008, Royal Society Wolfson Research Merit Award in 2009., Fermat Prize in 2013, FRS in 2014, Fröhlich Prize in 2014, Fields Medal in 2014.

Taming infinities

Some physical and mathematical theories have the unfortunate feature that if one takes them at face value, many quantities of interest appear to be infinite! Various techniques, usually going under the common name of "renormalisation" have been developed over the years to address this, allowing mathematicians and physicists to tame these infinities. We will tip our toes into some of the mathematical aspects of these techniques and we will see how they have recently been used to make precise analytical statements about the solutions of some equations whose meaning was not even clear until now.

Plenary Lecture - 3
Chair: Yudi Soeharyadi
10.30 - 11.30, July 27 (Wed), 2016
Room: Pecatu Hall 1 and 2

Narutaka Ozawa
Kyoto University

B.Sc. in Mathematics, University of Tokyo, 1997.

Ph.D. in Mathematics, Texas A & M University, 2001.

Professor at Research Institute for Mathematical Sciences, Kyoto University since 2013.

He has received a number of awards, including Spring Prize (Mathematical Society of Japan) in 2009, JSPS Prize (Japan Society for the Promotion of Science) in 2010.

Noncommutative real algebraic geometry of Kazhdan's property (T)

Kazhdan's property (T) is a representation-theoretic property of groups, which was introduced by Kazhdan in 1967, but has found numerous applications in an amazingly large variety of subjects from representation theory and ergodic theory to combinatorics (expanders) and the theory of networks. I will start with a gentle introduction to the emerging subject of "noncommutative real algebraic geometry," a subject which deals with equations and inequalities in noncommutative algebras over the reals, with the help of analytic tools such as representation theory and operator algebras. I will then present a surprisingly simple proof that a group G has property (T) if and only if a certain inequality in the group algebra $\mathbf{R}[G]$ is satisfied. This inequality is rather amenable to computer-assisted analysis and would be useful in finding new examples of property (T) groups or better bounds of the Kazhdan constants of known property (T) groups.

Plenary Lecture - 4
Chair: Sri Wahyuni
13.30 - 14.30, July 27 (Wed), 2016
Room: Pecatu Hall 1 and 2

Sug Woo Shin
UC Berkeley

Ph.D., Mathematics, Harvard University, Sep 2002-Jun 2007, Thesis: Counting points on Igusa varieties, supervised by Richard Taylor.
B. Sc., Mathematics, Seoul National University, Mar 1997-Feb 2000 (Military service, May 2000-Jul 2002).

Associate Professor, UC Berkeley, Jul 2014 - Present.

Research Interests number theory, Shimura varieties, Langlands functoriality, trace formula, automorphic forms.

Motives with Galois group of type G_2-construction of Gross and Savin revisited

Serre asked whether there exists a motive (over Q) with Galois group G_2. Put it in another way, the question is to find (a compatible family of) ell-adic Galois representations whose image has Zariski closure G_2. This has been answered affirmatively since 2010 by Dettweiler and Reiter, Khare-Larsen-Savin, Yun, and Patrikis (including generalizations to exceptional groups other than G_2). In this talk I revisit the construction of Gross-Savin (which was conditional when proposed in 1998) which aims to realize such a motive in the cohomology of a Siegel modular variety of genus 3 via exceptional theta correspondence between G_2 and $PGSp_6$. Then I will explain that the construction is now unconditional due to my recent work with Arno Kret on the construction of$GSpin(2n+1)$-valued Galois representations in the cohomology of Siegel modular varieties.

Plenary Lecture - 5
Chair: Chengbo Zhu
10.30 - 11.30, July 28 (Thu), 2016
Room: Pecatu Hall 1 and 2

Hendra Gunawan
Institut Teknologi Bandung

Ph.D. in Mathematics, University of New South Wales, Sydney (1992).
Sarjana (B.Sc. w/ thesis) in Mathematics, Bandung Institute of Technology (1987).

Professor, Institut Teknologi Bandung, 2006 - Present.

Research Interests
1. Fourier Analysis, particularly the theory of maximal functions, singular integrals, fractional integrals, and their applications.

2. Functional Analysis, particularly the theory of n-normed spaces and n-inner product spaces, and their applications (esp. in geometry).

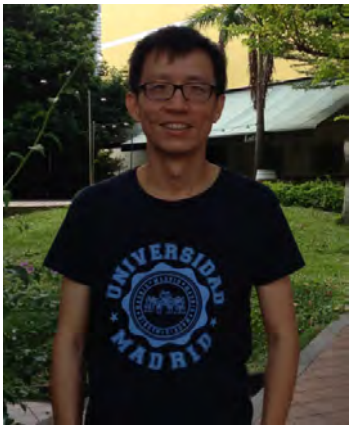
Fractional Integrals and Morrey Spaces

The talk will consist of two parts. In the first part, I will give a brief survey on Hardy-Littlewood maximal operator and fractional integral operators, especially about their boundedness properties on (generalized) Morrey spaces. The two operators were intially studied by G. Hardy & J. Littlewood and M. Riesz in the 1920's and the 1930's. Their boundedness on Morrey spaces was first proved by D. Adams and also by F. Chiarenza and M. Frasca in the 1970's and the 1980's. The results were generalized among others by E. Nakai in 1995, and I will present some recent results in this direction to indicate how 'hot' the topic is in the last two decades. In the second part, I will talk about basic but important properties of Morrey spaces, namely their inclusion properties. Here I will present some recent results not only for the 'strong' Morrey spaces but also weak type Morrey spaces, including their generalized versions. I shall also present some related results, and mention some future works.

Plenary Lecture - 6
Chair: Yong Hoon Lee
13.30 - 14.30, July 28 (Thu), 2016
Room: Pecatu Hall 1 and 2

Wee Teck Gan

National University of Singapore



Cambridge University: BA Honors (1991-1994)
Harvard University: PhD (1994-1998)
Princeton University and Institute of Advanced Studies: Veblen Research Instructor (1998-2001)

Princeton University: Assistant Professor (2001-2003)
University of California, San Diego: Assistant Professor (2003-2005); Associate Professor (2005-2009); Professor (2009-2011)

National University of Singapore: Visiting Professor (2010-2011); Professor (2011-now)

He has received a number of awards, including American Mathematics Society Centennial Fellowship: 2002-2003, Sloan Research Fellowship: 2003-2005, Invited address at the International Congress for Mathematicians (Number Theory session): August 2014, Outstanding researcher award, University Awards, NUS: April 2015.

Twisted Bhargava cubes and boxes

In his groundbreaking thesis work from 2001, Manjul Bhargava has extended Gauss's composition laws for binary quadratic forms to higher degree forms. One crucial ingredient in his work is the parametrisation of the orbits of lattice points in a prehomogeneous vector space by quantities of arithmetic interest. Using the SL(2,Z)x SL(2,Z)xSL(2,Z)-action on 2x2x2 cubes, he gave a simpler description of Gauss's law, and using the SL(2,Z) x SL(3,Z) x SL(3,Z)-action on 2x3x3 boxes, he discovered a composition law on binary cubic forms. In this lecture, we revisit these two orbit problems over fields (rather than integers) and consider twisted versions of them. In particular, we shall discuss the question: what are the orbits parametrised by?

Plenary Lecture - 7
Chair: Le Tuan Hoa
15.00 - 16.00, July 28 (Thu), 2016
Room: Pecatu Hall 1 and 2

Van H. Vu

Percey F. Smith Professor of Mathematics, Yale

1994-1998: Yale University, Department of Mathematics. Ph.D awarded May 1998 (Advisor Prof. L. Lovaśz).
He has received a number of awards, including Fulkerson prize (American Mathematics Society and Mathematical Optimization Society) in 2012, Medallion lecturer, eight World Congress in Probability and Statistics (Istanbul) in 2012, George Pólya prize (Society of Industrial and Applied Mathematics) in 2008, (Fall) Leader of focus program 'Arithmetic Combinatorics', Institute for Advance Study in 2007, and NSF Career Award in 2002.

Random functions

Studying the zeroes of of a function and its derivates (local maxima and minima, saddle points etc) is among the most basic and important problems in mathematics. Needless to say, there are hundreds of theorems on the topic, many give valuable information in some special cases, while being totally useless in others. There are no universally good estimates. In this talk, I am going to tell the story about what happens in the average case, namely when our function is random, following the footsteps of Littlewood, Offord, Kac, Erdos, Ibragimov and many leading mathematicians of the last century, and concluding with a current development that finished of some of the most basic problems.

Plenary Lecture - 8
Chair: Fengming Dong
10.30 - 11.30, July 29 (Fri), 2016
Room: Pecatu Hall 1 and 2

Zhou Xiangyu

Institute of Mathematics, CAS, Beijing

Ph.D.: Institute of Mathematics, Chinese Academy of Sciences, Beijing 1990.

M.Sc.: Institute of Mathematics, Chinese Academy of Sciences, Beijing 1988.

Research Interest: Several complex variables and complex geometry.

He has received a number of awards, including First Class Prize of the Natural Science Award of CAS in 1999, S.S. Chern Mathematics Prize (by Chinese Mathematical Society) in 2001, the National Natural Science Award of China (by State Council of China) in 2004, Russian's Doctor of Science (1998 at Steklov Mathematical Institute (Moscow)), Academician, Chinese Academy of Sciences (elected 2013), Onsager Professorship, NTNU, Trondheim, Norway in 2015.

Recent progress on multiplier ideal sheaves and optimal L^2 extensions

In this talk, we'll present our recent proof of Demailly's strong openness conjecture about multiplier ideal sheaves, solution of optimal L^2 extension problem, and their applications.

Plenary Lecture - 9
Chair: Indah E. Wijayanti
15.30 - 16.30, July 29 (Fri), 2016
Room: Pecatu Hall 1 and 2

V.S. Sunder
Institute of Mathematical Sciences at Chennai, India

A few years after completing his Ph.D. in operator theory under the guidance of P.R. Halmos, he moved over to operator algebras. He has contributed mainly to the area of subfactors and planar algebras in the past two decades. He has published more than 70 papers and eight books including a book on integral operators co-authored with Halmos and one on subfactors co-authored with Vaughan Jones. He has guided the Ph.D. theses of close to 10 students. He is a Fellow of all three science academies in India, and is a recipient of the S.S. Bhatnagar Prize, the highest recognition bestowed on a scientist by the Indian Government. More details about him can be found on his home-page https://www.imsc.res.in/sunder at the Institute of Mathematical Sciences at Chennai, India, where he has been for more than 20 years and is currently a senior Professor.

On a tensor-analogue of the Schur product

We consider the tensorial Schur product $R \circ^{\otimes} S = [r_{ij} \otimes s_{ij}]$ for $R \in M_n(\mathcal{A}), S \in M_n(\mathcal{B})$, with $\mathcal{A}, \mathcal{B}$ unital C^*-algebras and $R \circ^{\otimes} S$ viewed as an element of $M_n(\mathcal{C})$ for any C^*-algebra $\mathcal{C}$ containing the algebraic tensor product $\mathcal{A} \otimes_{alg} \mathcal{B}$; verify that such a 'tensorial Schur product' of positive operators is again positive and then use this fact to prove (an apparently marginally more general version of) the classical result of Choi that a linear map $\phi : M_n \longrightarrow M_d$ is completely positive if and only if $[\phi(E_{ij})] \in M_n(M_d)^+$, where of course $\{E_{ij} : 1 \leq i, j \leq n\}$ denotes the usual system of matrix units in $M_n(:= M_n(\mathbb{C}))$. We also discuss some other corollaries of the main result. (Joint work with K. Sumesh)

Special Lecture - 1
Chair: Rosihan M. Ali
11.30 - 12.30, July 26 (Tue), 2016
Room: Pecatu Hall 1 and 2

Desi Albert Mamahit
Badan Keamanan Laut, Republik Indonesia

Dr. Desi Albert Mamahit, M.Sc is a senior officer of Indonesian National Force graduated from Navy Academy in 1984. Since May 15th 2015, based on the Decree of TNI Commander Kep/475/VI/2015, he has been appointed as a Chief of Badan Keamanan Laut Republik Indonesia (BAKAMLA RI). Previously, he was mandated as the Rector of the Universitas Pertahanan Indonesia on March 21, 2014. Now, he is a special staff to the Indonesian Chief of Navy (Staf khusus Kepala Staf TNI AL) since April 2016.

Indonesia's maritime vision: The global maritime fulcrum

The Indonesian President Joko Widodo concept of a "global maritime fulcrum" as the centerpiece of his administration is fundamentally represents a national vision and development agenda to rebuild the country's maritime culture and expand its economy. Jokowi strongly believes the future of Indonesian prosperity rests on the revival of its maritime culture. The concept also signifies a new strategic doctrine that projects Indonesia to become a maritime power with considerable diplomatic influence. The global maritime fulcrum includes five pillars: reviving Indonesia's maritime culture as a basis of national identity; developing the fisheries industry and food security; boosting Indonesia's maritime economy; using maritime diplomacy to mitigate security concerns; and protecting Indonesia's sovereignty by bolstering maritime defenses.

The realization of President Joko Widodo's maritime doctrine entails the maintenance of national sovereignty, maritime safety and regional security. However, issues of illegal fishing, smuggling, drug trafficking and piracy or robberies at sea are particularly salient in Southeast Asia. The persisting territorial disputes over the South China Seas have led to rising maritime tensions and intensified major power rivalries. And, also the radicalism and terrorism remain at the forefront of Indonesia's domestic security concerns.

Against this backdrop, the paper seeks to explore the impact of Indonesia's maritime vision in foreign and defense policy. It will explore the concept of "global maritime fulcrum" and examine the strategic challenges facing the Indonesian Government for the next five years. The paper concludes by highlighting potential areas for defense and security cooperation between Indonesia and its strategic partners.

Special Lecture - 2
Chair: Gunardi
11.30 - 12.00, July 27 (Wed), 2016
Room: Pecatu Hall 1 and 2

Rianto Ahmadi Djojosugito
Society of Actuaries of Indonesia

Rianto Ahmadi Djojosugito is President of the Society of Actuaries of Indonesia. He did his undergraduate study in Mathematics in Institut Teknologi Bandung, and did his graduate studies in Statistics in University of Texas and University of Missouri.
Rianto got his fellowship certification from the Society of Actuaries of Indonesia and has worked as actuary and executive in the life insurance industry in Indonesia. He has also worked as instructor, lecturer and thesis supervisor in universities in the US and Indonesia.

Actuarial science program development in Indonesia

Gap between demand for actuarial human resources in the industries and supply of them is significant in Indonesia. Description of the problem and effort to minimize the gap including institutionalization of actuarial science program in appropriate universities in Indonesia as well as challenges faced in the effort are shared.

Special Lecture - 3
Chair: Gunardi
12.00 - 12.30, July 27 (Wed), 2016
Room: Pecatu Hall 1 and 2

General Agenda of AMC 2016 (Monday to Friday : July 25-29, 2016)

Time	Monday	Tuesday			Wednesday			Thursday			Friday	
	July 25, 2016	26-Jul-16			July 27, 2016			July 28, 2016			July 29, 2016	
		Main Activities		Additional Event	Main Activities		Additional Event	Main Activities		Additional Event	Main Activities	
08.00 - 08.30		Registration (Pecatu Foyer, BNDCC)				Poster Loading			Poster Loading			Poster Loading
08.30 - 09.00					Invited/Contributed Talks B (Mengwi & Legian Rooms) 11 paralel rooms (each 1,5 hours)	Poster Session B (Pecatu Hall 3&5)		Invited/Contributed Talks D (Mengwi & Legian Rooms) 11 paralel rooms (each 1,5 hours)	Poster Session D (Pecatu Hall 3&5)		Invited/Contributed Talks G (Mengwi & Legian Rooms) 11 paralel rooms (each 1,5 hours)	Poster Session F (Pecatu Hall 3&5)
09.00 - 09.30		Opening Session (Pecatu Hall 1&2) and Group Photos										
09.30 - 10.00												
10.00 - 10.30		Coffee Break (Pecatu Hall 3&5)			Coffee Break (Pecatu Hall 3&5)			Coffee Break (Pecatu Hall 3&5)			Coffee Break (Pecatu Hall 3&5)	
10.30 - 11.00		Plenary Lecture 1 (Pacatu Hall 1&2) (1 hour)			Plenary Lecture 3 (Pacatu Hall 1&2) (1 hour)			Plenary Lecture 5 (Pecatu Hall 1&2) (1 hour)			Plenary Lecture 8 (Pecatu Hall 1&2) (1 hour)	
11.00 - 11.30												
11.30 - 12.00		Special Lecture 1 (Pecatu Hall 1&2)			Special Lecture 2 (Pecatu Hall 1&2)			Invited/Contributed Talks E (Mengwi & Legian Rooms) 11 paralel rooms (1 hour)			Lunch (Tanjung Benoa Hall)	
12.00 - 12.30	Registration (Foyer)				Special Lecture 3 (Pecatu Hall 1&2)							
12.30 - 13.00		Lunch (Tanjung Benoa Hall)	Poster Loading		Lunch (Tanjung Benoa Hall)	Poster Loading		Lunch (Tanjung Benoa Hall)	Poster Loading			Poster Loading
13.00 - 13.30												
13.30 - 14.00		Plenary Lecture 2 (Pacatu Hall 1&2) (1 hour)			Plenary Lecture 4 (Pecatu Hall 1&2) (1 hour)			Plenary Lecture 6 (Pecatu Hall 1&2) (1 hour)			Invited/Contributed Talks H (Mengwi & Legian Rooms) 11 paralel rooms (1,5 hour)	
14.00 - 14.30												
14.30 - 15.00		Coffee Break (Pecatu Hall 3&5)	Poster Session A (Pecatu Hall 3&5)		Coffee Break (Pecatu Hall 3&5)	Poster Session C (Pecatu Hall 3&5)		Coffee Break (Pecatu Hall 3&5)	Poster Session E (Pecatu Hall 3&5)			
15.00 - 15.30		Invited/Contributed Talks A (Mengwi & Legian Rooms) 11 paralel rooms (each 2 hours)		SEAMS Council Meeting (Mengwi VVIP Room) (2 hours)	Invited/Contributed Talks C (Mengwi & Legian Rooms) 11 paralel rooms (each 1 hour)			Plenary Lecture 7 (Pecatu Hall 1&2) (1 hour)			Coffee Break (Pecatu Hall 3&5)	
15.30 - 16.00											Plenary Lecture 9 (Pecatu Hall 1&2) (1 hour)	
16.00 - 16.30					Mathematics Union Asia Forum (Pecatu Hall 1&2) (1,5 hours)			Invited/Contributed Talks F (Mengwi & Legian Rooms) 10 paralel rooms (1,5 hours)		Asian Woman Mathematics Forum (Pecatu Hall 1&2) (2 hours)		
16.30 - 17.00											Closing Session (Pecatu Hall 1&2)	
17.00 - 17.30												
17.30 - 18.00												
18.00 - 19.00												
19.00 - 20.00					Banquet Dinner							
20.00 - 21.00												

Tuesday

July 26, 2016

Time	Pecatu Hall 1 and 2	Pecatu Hall 3 and 5	Mengwi 1	Mengwi 2	Mengwi 3	Mengwi 5
10.30 - 11.30	James Maynard					
11.30 -12.30	V. S. Sunder					
13.30 - 14.30	Sudhir Ghorpade					
15.00 - 15.30	S01-IT-01 (Yue Yang)	POSTER A	S02-IT-01 (Erez Lapid)	S03-IT-01 (Shin Ichi Ohta)	S04-IT-01 (Tien C. Dinh)	S05-IT-01 (Hayato Chiba)
15.30 - 15.45	S01-CT-01		S02-CT-01	S03-IT-02 (Osamu Fujino)	S04-IT-02 (Park, Jinsung)	S05-CT-01
15.45 - 16.00	S01-CT-02		S02-CT-02			S05-CT-02
16.00 - 16.15	S01-CT-03		S02-CT-03	S03-CT-01	S04-CT-01	S05-CT-03
16.15 - 16.30	S01-CT-04		S02-CT-04	S03-CT-02	S04-CT-02	S05-CT-04
16.30 - 16.45	S01-CT-05		S02-CT-05	S03-CT-03	S04-CT-03	S05-CT-05
16.45 - 17.00	S01-CT-06		S02-CT-06	S03-CT-04	S04-CT-04	S05-CT-06

Time	Mengwi 6	Mengwi 7	Mengwi 8	Legian 1	Legian 2	Legian 3
15.00 - 15.30	S06-IT-01 (Hadi Susanto)	S07-IT-01 (Norbert	S08-IT-01 (Ian M. Wanless)	S09-IT-01 (Vincent Tan)	S09-IT-02 (Lee June-Yub)	S10-IT-01 (Hoang X. Phu)
15.30 - 15.45	S06-CT-01	S07-CT-01	S08-CT-01	S09-CT-01	S09-CT-07	S10-CT-01
15.45 - 16.00	S06-CT-02	S07-CT-02	S08-CT-02	S09-CT-02	S09-CT-08	S10-CT-02
16.00 - 16.15	S06-CT-03	S07-CT-03	S08-CT-03	S09-CT-03	S09-CT-09	S10-CT-03
16.15 - 16.30	S06-CT-04	S07-CT-04	S08-CT-04	S09-CT-04	S09-CT-10	S10-CT-04
16.30 - 16.45	S06-CT-05	S07-CT-05	S08-CT-05	S09-CT-05	S09-CT-11	S10-CT-05
16.45 - 17.00	S06-CT-06	S07-CT-06	S08-CT-06	S09-CT-06	S09-CT-12	S10-CT-06

July 27, 2016

Wednesday

Time	Pecatu Hall 1 and 2	Pecatu Hall 3 and 5	Mengwi 1	Mengwi 2	Mengwi 3	Mengwi 5
08.30 - 09.00	S01-IT-02 (Athipat Thamrongthanyalak)	POSTER B	S02-IT-02 (Claude Cibils)	S03-IT-03 (Zhang Ying)	S04-IT-03 (M. Mursaleen)	S05-IT-02 (Nguyen Dinh Cong)
09.00 - 09.15	S01-CT-07		S02-CT-07	S03-IT-04 (Yongnam Lee)	S04-CT-05	S05-CT-07
09.15 - 09.30	S01-CT-08		S02-CT-08		S04-CT-06	S05-CT-08
09.30 - 09.45	S01-CT-09		S02-CT-09	S03-CT-05	S04-CT-07	S05-CT-09
09.45 - 10.00	S01-CT-10		S02-CT-10	S03-CT-06	S04-CT-08	S05-CT-10
10.30 - 11.30	Martin Hairer					
11.30 - 12.00	Desi Albert Mamahit					
12.00 - 12.30	Rianto Ahmadi Djojosugito					
13.30 - 14.30	Narutaka Ozawa					
15.00 - 15.15	S01-IT-03 (Levi E. Elipane)	POSTER C	S02-IT-03 (Tomoki Mihara)	S05-IT-04 (M. S. M. Noorani)	S04-IT-04 (Seiichi Kamada)	S05-IT-03 (Nguyen Huu Du)
15.15 - 15.30						
15.30 - 15.45	S01-CT-11		S02-CT-11	S05-CT-13	S04-CT-09	S05-CT-11
15.45 - 16.00	S01-CT-12		S02-CT-12	S05-CT-14	S04-CT-10	S05-CT-12
Time	Mengwi 6	Mengwi 7	Mengwi 8	Legian 1	Legian 2	Legian 3
08.30 - 09.00		S07-IT-02 (Jean-Claude Zambrini)	S08-IT-02 (Fengming Dong)	S09-IT-03 (Chaoping Xing)	S09-IT-04 (Alhadi Bustamam)	S10-IT-02 (Roberd Saragih)
09.00 - 09.15	S07-CT-11	S07-CT-07	S08-CT-07	S09-CT-13	S09-CT-17	S10-CT-07
09.15 - 09.30	S07-CT-12	S07-CT-08	S08-CT-08	S09-CT-14	S09-CT-18	S10-CT-08
09.30 - 09.45	S07-CT-13	S07-CT-09	S08-CT-09	S09-CT-15	S09-CT-19	S10-CT-09
09.45 - 10.00	S07-CT-14	S07-CT-10	S08-CT-10	S09-CT-16	S09-CT-20	S10-CT-10
15.00 - 15.15	S06-IT-02 (Senjo Shimizu)	S07-IT-03 (Ana B. Cruzeiro)	S08-IT-03 (Hilda Assiyatun)	S09-CT-21	S09-CT-25	S10-IT-03 (Diah Chaerani)
15.15 - 15.30				S09-CT-22	S09-CT-26	
15.30 - 15.45	S06-CT-07	S07-CT-15	S08-CT-11	S09-CT-23	S09-CT-27	S10-CT-11
15.45 - 16.00	S06-CT-08	S07-CT-16	S08-CT-12	S09-CT-24	S09-CT-28	S10-CT-12

Thursday

July 28, 2016						
Time	Pecatu Hall 1 and 2	Pecatu Hall 3 and 5	Mengwi 1	Mengwi 2	Mengwi 3	Mengwi 5
08.30 - 09.00	S01-IT-04 (Yaya S Kusumah)	POSTER D	S02-IT-04 (Kwon Jae-Hoon)	S03-IT-05 (Michel Jambu)	S04-IT-05 (Rosihan M. Ali)	S08-IT-05 (M.M. Shikare)
09.00 - 09.15	S01-CT-13		S02-CT-13	S03-IT-06 (Poom Kumam)	S04-CT-11	S08-CT-16
09.15 - 09.30	S01-CT-14		S02-CT-14		S04-CT-12	S08-CT-17
09.30 - 09.45	S01-CT-15		S02-CT-15	S03-CT-07	S04-CT-13	S08-CT-18
09.45 - 10.00	S01-CT-16		S02-CT-16	S03-CT-08	S04-CT-14	S08-CT-19
10.30 - 11.30	Sug Woo Shin					
11.30 - 11.45	S02-IT-06 (Nor H. Sarmin)		S02-IT-05 (Karin Baur)	S04-IT-07 (Suthep Suantai)	S04-IT-06 (Maslina Darus)	S05-IT-05 (J.Tariboon)
11.45 - 12.00						
12.00 - 12.15	S02-CT-19		S02-CT-17	S04-CT-17	S04-CT-15	S05-CT-15
12.15 - 12.30	S02-CT-20		S02-CT-18	S04-CT-18	S04-CT-16	S05-CT-16
13.30 - 14.30	Hendra Gunawan					
15.00 - 16.00	Wee Teck Gan					
16.00 - 16.15	S08-IT-08 (Chia Gek Ling)	POSTER E	S02-IT-07 (Andrew Rajah)	S05-IT-07 (F. A. Kusumo)	S04-IT-08 (Duan Haibao)	S05-IT-06 (Jose E. C. Lope)
16.15 - 16.30						
16.30 - 16.45	S08-CT-32		S02-CT-21	S05-CT-21	S04-CT-19	S05-CT-17
16.45 - 17.00	S08-CT-33		S02-CT-22	S05-CT-22	S04-CT-20	S05-CT-18
17.00 - 17.15	S08-CT-34		S02-CT-23	S05-CT-23	S04-CT-21	S05-CT-19
17.00 - 17.30	S08-CT-35		S02-CT-24	S05-CT-24		S05-CT-20

Time	Mengwi 6	Mengwi 7	Mengwi 8	Legian 1	Legian 2	Legian 3
08.30 - 09.00	S06-IT-03 (Weizhu Bao)	S07-IT-04 (Hirofumi	S08-IT-04 (M. Yoshinaga)	S09-IT-05 (Susanne Brenner)		S10-IT-04 (Kim Chuan
09.00 - 09.15	S06-CT-09	S07-IT-05 (Wayan Mangku)	S08-CT-13	S09-CT-29	S09-CT-33	S10-CT-13
09.15 - 09.30	S06-CT-10		S08-CT-14	S09-CT-30	S09-CT-34	S10-CT-14
09.30 - 09.45	S06-CT-11	S07-CT-17	S08-CT-15	S09-CT-31	S09-CT-35	S10-CT-15
09.45 - 10.00		S07-CT-18		S09-CT-32	S09-CT-36	S10-CT-16
11.30 - 11.45	S06-IT-04 (Jaeyoung Byeon)	S07-IT-06 (Nicolas Privault)	S08-CT-20	S09-CT-37	S09-CT-41	S09-CT-45
11.45 - 12.00			S08-CT-21	S09-CT-38	S09-CT-42	S09-CT-46
12.00 - 12.15	S06-CT-12	S07-CT-19	S08-CT-22	S09-CT-39	S09-CT-43	S09-CT-47
12.15 - 12.30	S06-CT-13	S07-CT-20	S08-CT-23	S09-CT-40	S09-CT-44	S09-CT-48
16.00 - 16.15	S08-IT-07 (Xian'an Jin)	S07-IT-07 (Adrian Roellin)	S08-IT-06 (Manoj Changat)	S07-IT-08 (Dayue Chen)	S09-IT-06 (Zhou Jian)	
16.15 - 16.30						
16.30 - 16.45	S08-CT-28	S07-CT-21	S08-CT-24	S07-CT-25	S09-CT-49	S10-CT-17
16.45 - 17.00	S08-CT-29	S07-CT-22	S08-CT-25	S07-CT-26	S09-CT-50	S10-CT-18
17.00 - 17.15	S08-CT-30	S07-CT-23	S08-CT-26	S07-CT-27	S09-CT-51	S10-CT-19
17.00 - 17.30	S08-CT-31	S07-CT-24	S08-CT-27	S07-CT-28	S09-CT-52	

Friday

July 29, 2016						
Time	Pecatu Hall 1 and 2	Pecatu Hall 3 and 5	Mengwi 1	Mengwi 2	Mengwi 3	Mengwi 5
08.30 - 08.45	S02-CT-31	POSTER F	S02-CT-25	S03-CT-09	S04-CT-22	S05-CT-25
08.45 - 09.00	S02-CT-32		S02-CT-26	S03-CT-10	S04-CT-23	S05-CT-26
09.00 - 09.15	S02-CT-33		S02-CT-27	S03-CT-11	S04-CT-24	S05-CT-27
09.15 - 09.30	S02-CT-34		S02-CT-28	S03-CT-12	S04-CT-25	S05-CT-28
09.30 - 09.45	S02-CT-35		S02-CT-29	S03-CT-13	S04-CT-26	S05-CT-29
09.45 - 10.00	S02-CT-36		S02-CT-30	S03-CT-14	S04-CT-27	S05-CT-30
10.30 - 11.30	Van H. Vu					
13.30 - 13.45	S02-CT-42		S02-CT-37	S05-CT-35	S07-CT-46	S05-CT-31
13.45 - 14.00	S02-CT-43		S02-CT-38	S05-CT-36	S07-CT-47	S05-CT-32
14.00 - 14.15	S02-CT-44		S02-CT-39	S05-CT-37	S07-CT-48	S05-CT-33
14.15 - 14.30	S02-CT-45		S02-CT-40	S05-CT-38	S07-CT-49	S05-CT-34
14.30 - 14.45	S02-CT-46		S02-CT-41	S05-CT-39	S07-CT-50	S06-CT-14
14.45 - 15.00				S05-CT-40		S06-CT-15
15.30 - 16.30	Xiangyu Zhou					

Time	Mengwi 6	Mengwi 7	Mengwi 8	Legian 1	Legian 2	Legian 3
08.30 - 08.45	S08-CT-42	S07-CT-29	S08-CT-36	S09-CT-53	S09-CT-59	S07-CT-35
08.45 - 09.00	S08-CT-43	S07-CT-30	S08-CT-37	S09-CT-54	S09-CT-60	S07-CT-36
09.00 - 09.15	S08-CT-44	S07-CT-31	S08-CT-38	S09-CT-55	S09-CT-61	S07-CT-37
09.15 - 09.30	S08-CT-45	S07-CT-32	S08-CT-39	S09-CT-56	S09-CT-62	S07-CT-38
09.30 - 09.45	S08-CT-46	S07-CT-33	S08-CT-40	S09-CT-57	S09-CT-63	S07-CT-39
09.45 - 10.00	S08-CT-47	S07-CT-34	S08-CT-41	S09-CT-58	S09-CT-64	S07-CT-40
13.30 - 13.45	S08-CT-54	S07-CT-41	S08-CT-48	S09-CT-65	S09-CT-71	
13.45 - 14.00	S08-CT-55	S07-CT-42	S08-CT-49	S09-CT-66	S09-CT-72	
14.00 - 14.15	S08-CT-56	S07-CT-43	S08-CT-50	S09-CT-67	S09-CT-73	
14.15 - 14.30	S08-CT-57	S07-CT-44	S08-CT-51	S09-CT-68	S09-CT-74	
14.30 - 14.45	S08-CT-58	S07-CT-45	S08-CT-52	S09-CT-69	S09-CT-75	
14.45 - 15.00	S08-CT-59		S08-CT-53	S09-CT-70	S09-CT-76	

Tuesday	Wednesday		Thursday		Friday
July 26, 2016	July 27, 2016		July 28, 2016		July 29, 2016
15.00 - 17.00	08.30 - 10.00	15.00 - 16.00	08.30 - 10.00	16.00 - 17.30	08.30 - 10.00
Poster A	Poster B	Poster C	Poster D	Poster E	Poster F
S01 P-01 – P-09	S01 P-10 – P-19	S01 P-20 – P-29	S01 P-30 – P-39	S01 P-40 – P-49	S01 P-50 – P-59
S02 P-01 – P-08	S02 P-09 – P-15	S05 P-01 – P-06	S05 P-07 – P-12	S05 P-13 – P-18	S07 P-62 – P-73
S03 P-01 – P-06	S04 P-08 – P-14	S07 P-24 – P-36	S07 P-37 – P-48	S06 P-01 – P-07	S08 P-29 – P-36
S04 P-01 – P-07	S07 P-13 – P-23	S08 P-07 – P-13	S08 P-14 – P-21	S07 P-49 – P-61	S09 P-42 – P-48
S07 P-01 – P-12	S08 P-01 – P-06	S09 P-16 – P-26	S09 P-27 – P-34	S08 P-22 – P-28	S10 P-07 – P-14
S09 P-01 – P-08	S09 P-09 – P-15		S10 P-01 – P-06	S09 P-35 – P-41	

The Asian Mathematical Conference 2016

Program

PL. Plenary Lectures

(* : Speaker)

July 26 (Tue.) **Room: Pecatu Hall 1 and 2**

Chair: Intan Muchtadi

10.30 - 11.30 **Small (and large) gaps between primes**

James Maynard

Clay Research Fellowship [PL-01, p.121]

July 26 (Tue.) **Room: Pecatu Hall 1 and 2**

Chair: Fidel Nemenzo

13.30 - 14.30 **Number of zeros of multivariate polynomials over finite fields**

Sudhir Ramakant GHORPADE

Indian Institute of Technology, Bombay [PL-02, p.121]

July 27 (Wed.) **Room: Pecatu Hall 1 and 2**

Chair: Yudi Soeharyadi

10.30 - 11.30 **Taming infinities**

Martin Hairer

The University of Warwick [PL-03, p.122]

July 27 (Wed.) **Room: Pecatu Hall 1 and 2**

Chair: Sri Wahyuni

13.30 - 14.30 **Noncommutative real algebraic geometry of Kazhdan's property (T)**

Narutaka Ozawa

Kyoto University [PL-04, p.123]

July 28 (Thu.) **Room: Pecatu Hall 1 and 2**

Chair: Chengbo Zhu

10.30 - 11.30 **Motives with Galois group of type G_2-construction of Gross and Savin revisited**

Sug Woo Shin

UC Berkeley [PL-05, p.123]

July 28 (Thu.) **Room: Pecatu Hall 1 and 2**

Chair: Yong Hoon Lee

13.30 - 14.30 **Fractional Integrals and Morrey Spaces**

Hendra Gunawan

Institut Teknologi Bandung [PL-06, p.124]

July 28 (Thu.) **Room: Pecatu Hall 1 and 2**

Chair: Le Tuan Hoa

15.00 - 16.00 **Twisted Bhargava cubes and boxes**

Wee Teck Gan

National University of Singapore [PL-07, p.124]

July 29 (Fri.) **Room: Pecatu Hall 1 and 2**

Chair: Fengming Dong

10.30 - 11.30 **Random functions**

Van H. Vu

Percey F. Smith Professor of Mathematics, Yale [PL-08, p.125]

July 29 (Fri.) **Room: Pecatu Hall 1 and 2**

Chair: Indah E. Wijayanti

15.30 - 16.30 **Recent progress on multiplier ideal sheaves and optimal L^2 extensions**

Zhou Xiangyu

Institute of Mathematics, CAS, Beijing [PL-09, p.125]

SL. Special Lectures

(* : Speaker)

July 26 (Tue.) **Room: Pecatu Hall 1 and 2**

Chair: Rosihan M. Ali

11.30 - 12.30 **On a tensor-analogue of the Schur product**

V. S. Sunder

Institute of Mathematical Sciences at Chennai, India [SL-01, p.126]

July 27 (Wed.) **Room: Pecatu Hall 1 and 2**

Chair: Gunardi

11.30 - 12.00 **Indonesia's maritime vision: The global maritime fulcrum**

Desi Albert Mamahit

Badan Keamanan Laut, Indonesia [SL-02, p.126]

12.00 - 12.30 **Actuarial science program development in Indonesia**

Rianto Ahmadi Djojosugito

Society of Actuaries of Indonesia [SL-03, p.127]

Schedule of Sections S01 - S10

(* : Speaker)

S01. Logic and Foundations / Mathematics Education / History of Mathematics

Invited Talks

July 26 (Tue.) — **Room: Pecatu Hall 1 and 2**

Chair: Fedor Duzhin

15.00 - 15.30 **Reverse mathematics and Ramsey's theorem**
Yue Yang
National University of Singapore [S01-IT-01, p.128]

July 27 (Wed.) — **Room: Pecatu Hall 1 and 2**

Chair: Rully Charitas Indra Prahmana

08.30 - 09.00 **Continuous definable Skolem functions in d-minimal expansions of the real field**
Athipat Thamrongthanyalak
Chulalongkorn University, Thailand
Ohio State University, USA [S01-IT-02, p.129]

July 27 (Wed.) — **Room: Pecatu Hall 1 and 2**

Chair: Luis Manuel Tovar

15.00 - 15.30 **Addressing issues on (university) mathematics education via collaborative professional development**
Levi Esteban Elipane
De La Salle University, Manila [S01-IT-03, p.129]

July 28 (Thu.) — **Room: Pecatu Hall 1 and 2**

Chair: Natanael Karjanto

08.30 - 09.00 **Structured professional development programs for fostering mathematics teacher professionalism**
Yaya S. Kusumah
Universitas Pendidikan Indonesia, Bandung [S01-IT-04, p.130]

Contributed Talks

July 26 (Tue.)	Room: Pecatu Hall 1 and 2
15.30 - 17.00	Chair: Fedor Duzhin
15.30 - 15.45	**Investigation of contingency patterns of teachers' scaffolding in teaching and learning mathematics** Anwar*[1], Ipung Yuwono[2] Edy Bambang Irawan[2], Abdur Rahman As'ari[2] [1]Syiah Kuala University, Banda Aceh [2]State University of Malang [S01-CT-01, p.131]
15.45 - 16.00	**Comparing efficacy of pedagogical techniques using nonlinear mathematical models** Fedor Duzhin*[1], Artyom Markin[2], Katya Vladislavleva[2] [1]Nanyang Technological University [2]Evolved Analytics [S01-CT-02, p.131]
16.00 - 16.15	**Preliminary investigation of prospective mathematics teachers' critical thinking disposition** Abdur Rahman As'ari State University of Malang, Indonesia [S01-CT-03, p.132]
16.15 - 16.30	**Analysis of field dependent-prospective teacher's mathematical problem solving based on taxonomy of reflective thinking** Agustan[1], Dwi Juniati[2] [1]Universitas Muhammadiyah Makassar [2]Universitas Negeri Surabaya [S01-CT-04, p.132]
16.30 - 16.45	**The implementation of open inquiry approach to improve students learning activities, response, and mathematical creative thinking skills** Kadir*, Lucyana, Gusni Satriawati UIN Syarif Hidayatullah Jakarta [S01-CT-05, p.133]
16.45 - 17.00	**The relationship between math anxiety and students, attitudes, gender, personality types, and study habits at a case university in Jordan** Linda Smail Zayed University [S01-CT-06, p.134]

July 27 (Wed.)	**Room: Pecatu Hall 1 and 2**
09.00 - 10.00	Chair: Rully Charitas Indra Prahmana
09.00 - 09.15	**The changing scenario of mathematics formative assessment in the era of globalization (a Philippine university's undergraduate experience)** Maria Linda C. Cabillan*, Joezel R. Ambrosio Rhona Lyn R. Bautista, John Carlo P. Unson* Glory Ann Julien C. Winnan Saint Louis University, Philippines [S01-CT-07, p.134]
09.15 - 09.30	**The role of research-based learning to enhance student's research and academic writing skills** Rully Charitas Indra Prahmana*[1], Yaya S. Kusumah[2], Darhim[2] [1]Surya College of Education, Indonesia [2]Indonesia University of Education, Indonesia [S01-CT-08, p.135]
09.30 - 09.45	**Teachers' approach in teaching derivative to high school students: giving tasks and assessments** Rita Desfitri University of Bung Hatta, Indonesia [S01-CT-09, p.136]
09.45 - 10.00	**On the Vietnamese mathematical book of Nguyen Huu Than** Alexei Volkov[1], Thi Le Doan[2], Duy Phuong Ta*[3] [1]National Tsing-Hua University, Hsinchu, Taiwan [2]Hanoi National University of Education [3]Vietnam Academy of Science and Technology [S01-CT-10, p.136]

July 27 (Wed.)	**Room: Pecatu Hall 1 and 2**
15.30 - 16.00	Chair: Luis Manuel Tovar
15.30 - 15.45	**History of complex analysis** Luis Manuel Tovar ESFM, Instituto Politecnico Nacional, Mexico [S01-CT-11, p.137]
15.45 - 16.00	**Analysis of historical perspective in reinventing mathematics concept on Indonesian mathematics textbook** Rooselyna Ekawati, Shofan Fiangga Universitas Negeri Surabaya [S01-CT-12, p.137]

July 28 (Thu.)	**Room: Pecatu Hall 1 and 2**
09.00 - 10.00	Chair: Natanael Karjanto
09.00 - 09.15	**Blending flipped classroom with CAS *maxima* in an introductorycalculus course** Natanael Karjanto Sungkyunkwan University, South Korea [S01-CT-13, p.138]

09.15 - 09.30 **Development of mathematics assistantship materials on fractions for primary teachers in the implementation of curriculum 2013**
Siti Khabibah*, Siti M. Amin, Agung Lukito
Universitas Negeri Surabaya (Unesa), Indonesia [S01-CT-14, p.139]

09.30 - 09.45 **Facebook: playing significant role in mathematics teaching learning process**
Rodulfo T. Aunzo, Jr. Ed.D
University of San Carlos, Philippines [S01-CT-15, p.140]

09.45 - 10.00 **Examining learning obstacle of students college from Papua-Indonesia**
Sulistiawati*, Arumella Surgandini
Surya College of Education (STKIP Surya) [S01-CT-16, p.140]

Poster Session

July 26 (Tue.) **Room: Pecatu Hall 3 and 5**

15.00 - 17.00

15.00 - 17.00 **Attitude toward mathematics among the students at Nazarbayev University foundation year programme**
Akbota Mukhamediyeva*[1], Natanael Karjanto[2], Aknur Kozhagapar[1]
[1]Nazarbayev University, Kazakhstan
[2]Sungkyunkwan University, South Korea [S01-P-01, p.141]

15.00 - 17.00 **Affect of interactive media and manipulatives on improving mathematical abilities of 5th grades students**
Prih Hartanti[1], Yurniwati*[2]
[1]SDIT RPI Jakarta, Indonesia
[2]Jakarta State University, Indonesia [S01-P-02, p.142]

15.00 - 17.00 **Reflective thinking in solving algebra problem: a case study of reflective-prospective teacher**
Agustan*[1], Dwi Juniati[2], Tatag YES[2]
[1]Universitas Muhammadiyah Makassar, Indonesia
[2]Universitas Negeri Surabaya, Indonesia [S01-P-03, p.142]

15.00 - 17.00 **Teaching mathematics to K-12 students using artifacts from Museo De La Salle**
Ma. Theresa Christine C. Valdez*, Edwin S. Bunag, Lea D. Maderal
De La Salle University-Dasmarinas, Philippines [S01-P-04, p.143]

15.00 - 17.00 **Probabilistic thinking of elementary school students in solving probability task using experiments and non experiments**
Dwi Ivayana Sari *[1], I Ketut Budayasa[2], Dwi Juniati[2]
[1]STKIP PGRI Bangkalan, Indonesia
[2]Universitas Negeri Surabaya, Indonesia [S01-P-05, p.143]

15.00 - 17.00 **Metacognitive profile of a female prospective teacher with cognitive field independent style in solving limit problem**
Pathuddin*, I Ketut Budayasa, Agung Lukito
Surabaya State University Indonesia [S01-P-06, p.144]

15.00 - 17.00 **Adaptive reasoning and strategic competence in solving mathematical problem: a case study of female-field independent (F1) student**
Andi Syukriani*[1], Dwi Juniati[2], Tatag YES[2]
[1]STKIP-Pembangunan Indonesia Makassar, Indonesia
[2]Universitas Negeri Surabaya, Indonesia [S01-P-07, p.145]

15.00 - 17.00 **Prospective teachers conception about limit function**
Usman[1], Dwi Juniati[2], Tatag Yuli Eko Siswono[2]
[1]Syiah Kuala University, [2]Surabaya State University [S01-P-08, p.145]

15.00 - 17.00 **Straight line equation scheme of student in grade 8 Christian Junior High School Salatiga**
Herlina*, Kriswandani
Satya Wacana Christian University [S01-P-09, p.146]

July 27 (Wed.) **Room: Pecatu Hall 3 and 5**

08.30 - 10.00

08.30 - 10.00 **Student metacognition in solving open-ended problems**
Zainnur Wijayanto
UST, Indonesia [S01-P-10, p.146]

08.30 - 10.00 **Characteristics fragmentation of structure students thinking in solving mathematical problems**
Kadek Adi Wibawa*[1], Toto Nusantara[2], Subanji[2], I Nengah Parta[2]
[1]University Mahasaraswati of Denpasar, Indonesia
[2]Malang State of University, Indonesia [S01-P-11, p.147]

08.30 - 10.00 **The mathematical profiency of elementary student winning the national olympiad medals in science in making equation**
Syarifatul Maf'ulah*[1], Dwi Juniati[2], Tatag Yuli Eko Siswono[2]
[1]STKIP PGRI Jombang, Indonesia
[2]Universitas Negeri Surabaya, Indonesia [S01-P-12, p.148]

08.30 - 10.00 **The effect of mathematical investigation on students' intention to conduct mathematical research**
Jonny Bernas Pornel
University of the Philippines Visayas, Philippines [S01-P-13, p.149]

08.30 - 10.00 **Teacher's pedagogical content knowledge in mathematics subject on limit of function**
Ma'rufi*[1], I Ketut Budayasa*[2], Dwi Juniati[2]
[1]Universitas Cokroaminoto Palopo, Indonesia
[2]Universitas Negeri Surabaya, Indonesia [S01-P-14, p.149]

08.30 - 10.00 **GView a geometrical teaching aids development based on augmented reality**
Iqbal Wahyu Septiyadi*, Ahmad Zulfakar Rahmadi, Alfa Satyaputra
STKIP Surya, Indonesia [S01-P-15, p.150]

08.30 - 10.00 **Types of warrant in mathematical argumentations of prospective-teacher students**
Lia Budi Tristanti*[1], Akbar Sutawidjaja[2], Abdur R. As'ari[2], Makbul Muksar[2]
[1]STKIP PGRI Jombang, Indonesia
[2]Malang State University, Indonesia [S01-P-16, p.151]

08.30 - 10.00 **Strategy of proportional reasoning of junior high school students in mathematical problem**
Marwia Tamrin Bakar*[1,2], Yuli Fitrianti[1,3]
[1]Indonesia University of Education
[2]Universitas Khairun, Indonesia
[3]Universitas Islam Negeri Raden Fatah, Indonesia [S01-P-17, p.151]

08.30 - 10.00 **Revealing the fundamental ideas of algebra through exploration of history of algebraic thinking: a literature review**
Yuli Fitrianti*[1,2], Marwia Tamrin Bakar[1,3]
[1]Indonesia University of Education
[3]Universitas Islam Negeri Raden Fatah, Indonesia
[2]Universitas Khairun, Indonesia [S01-P-18, p.152]

08.30 - 10.00 **Influence of learning subtraction based on critical point in Matematika GASING towards students achievement**
Mika Meitriana Manurung*, Lukman Fakhmi, Nofrianti, Johannes Siregar
STKIP Surya, Indonesia [S01-P-19, p.152]

July 27 (Wed.) **Room: Pecatu Hall 3 and 5**

15.00 - 16.00

15.00 - 16.00 **Identification junior high school student's geometry skills based on Van Hiele's thinking level**
Qurniawan Agung Putra*, Qopa Almaisurie
Ira Silviana Rahman, Nerru Pranuta Murnaka
STKIP Surya Tangerang, Indonesia [S01-P-20, p.153]

15.00 - 16.00 **Mathematics mobile learning application as supplement for senior high school students to learn trigonometry**
Dani Kusuma*, Tri Nova Hasti Yunianta
Satya Wacana Christian University, Indonesia [S01-P-21, p.154]

15.00 - 16.00 **Investigation of impacting factors for learning achievement of mathematics students**
Ferry Vincenttius Ferdinand*, Samuel Lukas
Universitas Pelita Harapan, Indonesia [S01-P-22, p.154]

15.00 - 16.00 **Linear equation system of two variablesscheme of student in grade X Senior High School of state 2 Salatiga**
Bayu Setyo Nugroho, Kriswandani
Satya Wacana Christian University [S01-P-23, p.155]

15.00 - 16.00 **The quantitative reasoning ability of mathematics pre-service teacher in the topic of statistical data analysis**
Agustinus Sroyer
Cenderawasih University, Jayapura, Papua, Indonesia [S01-P-24, p.156]

15.00 - 16.00 **Minimizing student's fault in determining the design of experiment through inquiry-based learning**
D. P. E. Nilakusmawati*, Made Susilawati
Udayana University, Indonesia [S01-P-25, p.156]

15.00 - 16.00 **Learning sum of series through a black dot for primary school**
Sari Juliana*, Novi Purnama Sari, Lilis S.J. Manullang, Bobbi Rahman
STKIP Surya, Indonesia [S01-P-26, p.157]

15.00 - 16.00 **Process of constructing proof by graduate student based on reflective abstraction**
Syukma Netti*[1], Akbar Sutawidjaja[2], Subanji[2], Sri Mulyati[2], Sudirman[2]
[1]Bung Hatta University, Indonesia
[2]Malang State University, Indonesia [S01-P-27, p.157]

15.00 - 16.00 **Learning algebra in early mathematics education through magic box**
Novi Purnama Sari, Lilis S.J. Manullang*, Sari Juliana, Bobbi Rahman
STKIP Surya, Indonesia [S01-P-28, p.158]

15.00 - 16.00 **LAPS (Logan Avenue Problem Solving)-heuristic model on increasing student's critical thinking skill**
Ira Silviana Rahman*, Nerru Pranuta Murnaka
STKIP Surya, Indonesia [S01-P-29, p.159]

July 28 (Thu.) **Room: Pecatu Hall 3 and 5**

08.30 - 10.00

08.30 - 10.00 **The influence of learning style toward student learning outcome about multiplication using Matematika Gasing**
Nia Yuniarti, Asri Gita, Nerru Pranuta Murnaka
STKIP Surya, Indonesia [S01-P-30, p.159]

08.30 - 10.00 **The principle of temple width technic and projection of matrix in the addition operation of sequence of square**
Subaryanto[1], Choirul Huda[1]
Rendy Wikrama Wardana[2], Riany Oktaviani Sungkawa[3]
[1]Math. Teachers Senior High School State 4 Muaro Jambi Indonesia
[2]Science Edu. Postgraduate School UPI Indonesia
[3]Enghlish Edu. Undergraduate School UPI Indonesia [S01-P-31, p.160]

08.30 - 10.00 **Ethnomathematics in Sundanese cultural perspective**
Atje Setiawan Abdullah
Universitas Padjadjaran [S01-P-32, p.160]

08.30 - 10.00 **The increase students' learning activities in elementary statistics course with cooperative learning**
Yusri Wahyuni
University of Bung Hatta, Indonesia [S01-P-33, p.161]

08.30 - 10.00 **Design and validation of teaching mathematics books based on ICT with CD tutorial for senior high school student grade X 1^{st} semester**
Tika Septia*, Sofia Edriati
STKIP PGRI West Sumatera, Indonesia [S01-P-34, p.162]

08.30 - 10.00 **Bankruptcy prediction of bond using time-varying default as default time rule (barrier empirical study in some Indonesian corporate bond data)**
Di Asih I Maruddani*, Triastuti Wuryandari, Abdul Hoyyi
Diponegoro University, Indonesia [S01-P-35, p.162]

08.30 - 10.00 **Analysis and description of authentic assessment in calculus subject**
Zulfaneti*, Sofia Edriati, Mukhni
STKIP PGRI Sumatera Barat, Indonesia [S01-P-36, p.163]

08.30 - 10.00 **Attitudes towards Mathematics: effects of gender and school type**
Alyaa Nadiah Mohamed, Fatimah Abdul Razak*
Universiti Kebangsaan Malaysia [S01-P-37, p.164]

08.30 - 10.00 **Analysis of early stage module development based on guided discovery on transformational geometry course at STKIP PGRI in West Sumatra**
Rina Febriana, Yulia Haryono
STKIP PGRI Sumatera Barat, Indonesia [S01-P-38, p.164]

08.30 - 10.00 **Associations between mathematics classroom learning environtments and achievement in University of PGRI Adi Buana Surabaya Indonesia**
Erna Puji Astutik
University of PGRI Adi Buana Surabaya, Indonesia [S01-P-39, p.165]

July 28 (Thu.)	**Room: Pecatu Hall 3 and 5**
16.00 - 17.30	
16.00 - 17.30	**Analysis prior knowledge students metacognition STKIP PGRI West Sumatera in problem solving** Dewi Yuliana Fitri*, Merina Pratiwi, Villia Anggraini STKIP PGRI West Sumatera, Indonesia [S01-P-40, p.166]
16.00 - 17.30	**Analysis student's interest towards geometry learning with origami** Dinna Cilvia Asri*, Ayu Mentari*, Nerru Pranuta Murnaka STKIP SURYA, Indonesia [S01-P-41, p.167]
16.00 - 17.30	**Developing of SMART based teaching and learning sets of geometry for grade VII** Muchamad Subali Noto Swadaya Gunung Djati University, Indonesia [S01-P-42, p.167]
16.00 - 17.30	**Analysis of Yahalom, wide-mouth-frog and needham schroeder protocol using BAN logic: a survey** Annisa Dini Handayani[1], Amrizal Arif Rakhmadi[2] [1]Sekolah Tinggi Sandi Negara, indonesia [2]Lembaga Sandi Negara, Indonesia [S01-P-43, p.168]
16.00 - 17.30	**The development of teachers′ lesson design through continuous review and role playing activities** Indira Puteri Kinasih IKIP Mataram, Indonesia [S01-P-44, p.169]
16.00 - 17.30	**Open-ended problem solving of circle based on polya stage towards students of state junior high school 5 Salatiga** Novisita Ratu*, Erlina Prihatnani Satya Wacana Christian University, Indonesia [S01-P-45, p.169]
16.00 - 17.30	**Student's understanding of graphics-based information processing** Helti Lygia Mampouw, Agung Lukito, St Suwarsono [1]Satya Wacana Christian University, [2]State University of Surabaya [3]Sanata Dharma University [S01-P-46, p.170]
16.00 - 17.30	**Elementary school students' multiple intelligence in mathematics problem solving** Hanim Faizah University of PGRI Adi Buana Surabaya, Indonesia [S01-P-47, p.170]
16.00 - 17.30	**The development of learning media based interactive math comic for students of VIII grade of junior high school** Niniwati*, Rahmanda Saputra Bung Hatta University, Indonesia [S01-P-48, p.171]
16.00 - 17.30	**Future rural area pre-service teachers' mathematics anxiety** Bobbi Rahman, Novi Purnama Sari*, Lilis S.J. Manullang, Sari Juliana STKIP Surya, Indonesia [S01-P-49, p.172]

July 29 (Fri.) **Room: Pecatu Hall 3 and 5**

08.30 - 10.00

08.30 - 10.00	**The structural equation modeling (sem) and its application on factors modeling which are effected on students' academic achievement (case study: Universitas Surabaya)** Lina Natalya[1], Muhammad Mashuri[1], Ide Bagus Siaputra[2] [1]Inst. Teknologi Sepuluh Nopember, [2]Univ. Surabaya	[S01-P-50, p.172]
08.30 - 10.00	**Teacher's knowledge of students in learning mathematics on limit of fucntion material** Ma'rufi*, I Ketut Budayasa*, Dwi Juniati* [1]Universitas Cokroaminoto Palopo, Indonesia [2]Universitas Negeri Surabaya, Indonesia	[S01-P-51, p.173]
08.30 - 10.00	**The development of learning equipment in applying character-based learning model by involving emotional intellegence in compiling basic research proposal of teacher-candidate students** Muhammad Ilyas Universitas Cokroaminoto Palopo, Indonesia	[S01-P-52, p.173]
08.30 - 10.00	**Developing learning of plane area concepts at elementary level using prior knowledge and stored new knowledge** Abdul Muin[1], Didi Suryadi[2], Kadir[1] [1]UIN Syarif Hidayatullah Jakarta, [2]UPI Indonesia	[S01-P-53, p.174]
08.30 - 10.00	**The effects of group investigation method on student's critical thinking in mathemathics education** Qurniawan Agung Putra, Nerru Pranuta Murnaka STKIP Surya Tangerang	[S01-P-54, p.175]
08.30 - 10.00	**The role of ethnomathematics in West Java (case study in Cipatujah)** Dianne A. Kusuma*, Stanley P. Dewanto, Budi N. Ruchjana, Atje S. Abdullah Universitas Padjadjaran, Indonesia	[S01-P-55, p.176]
08.30 - 10.00	**Identification Junior High School student's critical thinking skills** Qopa Almaisurie, Nerru Pranuta Murnaka STKIP Surya Tangerang	[S01-P-56, p.176]
08.30 - 10.00	**Design for abstraction: a case study on pre-service mathematics teachers** Farida Nurhasanah Sebelas Maret University	[S01-P-57, p.177]
08.30 - 10.00	**Preservice teacher's segmentation and fragmentation in solving mathematics problems using cognitive mapping** Wyrasti A.F, Sa'dijah C, Mulyati S, Sulendra I.M	[S01-P-58, p.177]
08.30 - 10.00	**Differences between mathematical creative thinking abilities of students are taught with realistic mathematics education approach and deductive in UHAMKA Jakarta** Sigid Edy Purwanto University of Muhammadiyah Prof. Dr. HAMKA	[S01-P-59, p.178]

S02. Algebra / Lie Theory and Generalizations, Number Theory

Invited Talks

July 26 (Tue.) — **Room: Mengwi 1**

Chair: Dellavitha Nasution

15.00 - 15.30 **Some aspects of representation theory of GL_n and classical groups over a non-archimedean local field**

Erez Lapid*[1], Alberto Mínguez[2], Marko Tadić[3]
[1]Weizmann Institute of Science
[2]Institut de Mathématiques de Jussieu
[3]University of Zagreb

[S02-IT-01, p.179]

July 27 (Wed.) — **Room: Mengwi 1**

Chair: Daryl Q. Granario

08.30 - 09.00 **Hopf linear categories over a group and their fundamental group**

Claude Cibils
Université de Montpellier, France

[S02-IT-02, p.179]

July 27 (Wed.) — **Room: Mengwi 1**

Chair: Julius Fergy T. Rabago

15.00 - 15.30 **Characterisation of the Berkovich spectrum of the banach algebra of bounded continuous functions**

Tomoki Mihara
Tokyo Institute of Technology, Japan

[S02-IT-03, p.180]

July 28 (Thu.) — **Room: Mengwi 1**

Chair: Norarida Abd Rhani

08.30 - 09.00 **Quantum ortho-symplectic superalgebras and crystal bases**

Jae-Hoon Kwon
Seoul National University, Korea

[S02-IT-04, p.180]

July 28 (Thu.) — **Room: Mengwi 1**

Chair: Jerome T. Dimabayao

11.30 - 12.00 **Dimer models and Grassmannian cluster categories**

Karin Baur
University of Graz

[S02-IT-05, p.180]

July 28 (Thu.) **Room: Pecatu Hall 1 and 2**

Chair: Janus C. Aban

11.30 - 12.00 **Recent updates on homological invariant of Bieberbach groups**

Nor Haniza Sarmin*[1], Siti Afiqah Mohammad[1],
Hazzirah Izzati Mat Hassim[1], Norashiqin Mohd Idrus[2],
Rohaidah Masri[2], Yee Ting Tan[2]
[1]Universiti Teknologi Malaysia
[2]Universiti Pendidikan Sultan Idris [S02-IT-06, p.181]

July 28 (Thu.) **Room: Mengwi 1**

Chair: Aliw-iw Zambrano

16.00 - 16.30 **Moufang loops of odd order $p^4q_1^3 \cdots q_n^3$**

Andrew Rajah*, Lois Adewoye Ademola
Universiti Sains Malaysia [S02-IT-07, p.181]

Contributed Talks

July 26 (Tue.) **Room: Mengwi 1**

15.30 - 17.00 Chair: Dellavitha Nasution

15.30 - 15.45 **Varieties of U-complexes**

Dellavitha Nasution
Algebra Research Group ITB [S02-CT-01, p.182]

15.45 - 16.00 **Rank gain of Jacobians over finite Galois extensions**

Bo-Hae Im*[1], Erik Wallace[2]
[1]Chung-Ang University, South Korea
[2]The Einstein Institute of Mathematics, Israel [S02-CT-02, p.182]

16.00 - 16.15 **On weakly second submodules over noncommutative rings**

Indah Emilia Wijayanti, Dian Ariesta Yuwaningsih, Sri Wahyuni
Universitas Gadjah Mada, Indonesia [S02-CT-03, p.183]

16.15 - 16.30 **The nonabelian tensor square of a crystallographic group with quaternion point group of order eight**

Siti Afiqah Mohammad*, Nor Haniza Sarmin
Hazzirah Izzati Mat Hassim
Universiti Teknologi Malaysia, Malaysia [S02-CT-04, p.183]

16.30 - 16.45 **$*_p-$Modules and special class of modules determined by the essential closure of the class of all $*-$rings**

Puguh Wahyu Prasetyo*[1], Indah E. Wijayanti[2], Halina France-Jackson[3]
[1,2]Universitas Gadjah Mada, Indonesia
[3]Nelson Mandela Metropolitan Univ., South Africa [S02-CT-05, p.184]

16.45 - 17.00 **Conjugation action on the family of minimum $\mathscr{D}$-sets of a group**
Jose Maria P. Balmaceda[1], Joris N. Buloron[*2]
[1]University of the Philippines Diliman
[2]Cebu Normal University, The Philippines [S02-CT-06, p.184]

July 27 (Wed.) **Room: Mengwi 1**

09.00 - 10.00 Chair: Daryl Q. Granario

09.00 - 09.15 **The ψ_S polar decomposition when the cosquare of S is normal**
Daryl Q. Granario[*1], Dennis I. Merino[2], Agnes T. Paras[3]
[1]Auburn University, USA
[2]Southeastern Louisiana University, USA
[3]University of the Philippines-Diliman [S02-CT-07, p.185]

09.15 - 09.30 **On graded N-prime submodule of module of fraction of graded module**
Sutopo[*], Indah Emilia Wijayanti, Sri Wahyuni
Universitas Gadjah Mada, Indonesia [S02-CT-08, p.185]

09.30 - 09.45 **On a separation and irreducibility problem of polynomials from the nonlinear Schrodinger equation**
Bich Van Nguyen
Institute of Mathematics,VAST, Hanoi, Vietnam [S02-CT-09, p.186]

09.45 - 10.00 **On quasi and bi-hyper KS-ideals of hyper KS-semigroups**
Jocelyn P. Vilela[*1], Georgie F. Tabaranza[2]
MSU-Iligan Insitute of Technology, The Philippines [S02-CT-10, p.186]

July 27 (Wed.) **Room: Mengwi 1**

15.30 - 16.00 Chair: Julius Fergy T. Rabago

15.30 - 15.45 **String C-groups of order** 2048 **and rank** 3
Mark L. Loyola[*]
Ma. Louise Antonette N. De Las Peñas, Yasushi Gomi
Ateneo de Manila University, The Philippines [S02-CT-11, p.187]

15.45 - 16.00 **An intriguing application of telescoping sums**
Julius Fergy T. Rabago[*]
University of the Philippines Baguio [S02-CT-12, p.188]

July 28 (Tue.)	**Room: Mengwi 1**
09.00 - 10.00	Chair: Norarida Abd Rhani
09.00 - 09.15	**Some properties of derived graph algebras** C. Manyuen*, P. Jampachon, T. Poomsa-Ard Khon Kaen University, Thailand [S02-CT-13, p.188]
09.15 - 09.30	**On the bounds of the subset relative degree of a group** Norarida Abd Rhani*, Nor Muhainiah Mohd Ali Nor Haniza Sarmin, Ahmad Erfanian Universiti Teknologi Malaysia, Johor, Malaysia [S02-CT-14, p.189]
09.30 - 09.45	**On a generalization of an Abelian ring** Eun-Kyung Cho*, Yang Lee Pusan National University, South Korea [S02-CT-15, p.189]
09.45 - 10.00	**On endomorphism rings of max CS and min CS modules** Thuat Van Do *[1], Nguyen Van Sanh [2] [1]Nguyen Tat Thanh University, Vietnam [2]Mahidol University, Thailand [S02-CT-16, p.190]

July 28 (Tue.)	**Room: Mengwi 1**
12.00 - 12.30	Chair: Jerome T. Dimabayao
12.00 - 12.15	**On the cohomological coprimality of Galois representations associated with elliptic curves** Jerome T. Dimabayao University of the Philippines Diliman [S02-CT-17, p.190]
12.15 - 12.30	**Skew polynomial ring of a Morita ring of Morita context** Yoshua Yonatan Hamonangan*[1], Intan Muchtadi-Alamsyah[2] Institut Teknologi Bandung, Indonesia [S02-CT-18, p.191]

July 28 (Tue.)	**Room: Pecatu Hall 1 and 2**
12.00 - 12.30	Chair: Janus C. Aban
12.00 - 12.15	**Construction of cyclic codes over ternary fields using periodic sequences** Azhar Syarifuddin*, Intan Muchtadi-Alamsyah Institut Teknologi Bandung, Indonesia [S02-CT-19, p.191]
12.15 - 12.30	**On the p-adic analogue of the Newton-Raphson method for finding the zero of a polynomial** Janus C. Aban*, Julius M. Basilla University of the Philippines Diliman [S02-CT-20, p.191]

July 28 (Tue.)	**Room: Mengwi 1**
16.30 - 17.30	Chair: Aliw-iw Zambrano
16.30 - 16.45	**Full identification of idempotents in binary Abelian group rings** Kai Lin Ong*, Miin Huey Ang Universiti Sains Malaysia, Malaysia [S02-CT-21, p.192]
16.45 - 17.00	**Construction of mathematical weavings in the plane** Aliw-iw Zambrano*, Eden Delight Miro, Agnes Garciano Ateneo de Manila University, The Philippines [S02-CT-22, p.192]
17.00 - 17.15	**On representation of polynomial ring on a vector space via a linear transformation** Sri Wahyuni*[1], Indah Emilia Wijayanti[1], Na'imah Hijriati[1,2] [1]Universitas Gadjah Mada, Indonesia [2]Universitas Lambung Mangkurat, Indonesia [S02-CT-23, p.193]
17.15 - 17.30	**Lattice structure of weak hyper ks-ideals of a hyper KS-semigroup** Longrio Platil*, Susan Dagondon MSU-Iligan Institute of Tech., The Philippines [S02-CT-24, p.193]

July 29 (Fri.)	**Room: Mengwi 1**
08.30 - 10.00	Chair: Siti Norziahidayu Amzee Zamri
08.30 - 08.45	**On some falling fuzzy in BCI-algebras** Alireza Gilani Islamic Azad University, Iran [S02-CT-25, p.194]
08.45 - 09.00	**An extension of the commutativity degree of a metacyclic 3-group** Siti Norziahidayu Amzee Zamri* Nor Haniza Sarmin, Hazzirah Izzati Mat Hassim Universiti Teknologi Malaysia [S02-CT-26, p.194]
09.00 - 09.15	**On X-sub-linearly independent modules** Fitriani*[1,2], Budi Surodjo[1], Indah Emilia Wijayanti[1] [1]Universitas Gadjah Mada, Indonesia [2]Universitas Lampung, Indonesia [S02-CT-27, p.195]
09.15 - 09.30	**Construction of derived category of $U-$complexes** Gustina Elfiyanti*, Intan Muchtadi-Alamsyah, Dellavitha Nasution Institut Teknologi Bandung, Indonesia [S02-CT-28, p.195]
09.30 - 09.45	**On representation of a ring on a free modules over a commutative ring with identity** Na'imah Hijriati*[1,2], Sri Wahyuni[2], Indah Emilia Wijayanti[2] [1]Universitas Lambung Mangkurat, Indonesia [1]Universitas Gadjah Mada, Indonesia [S02-CT-29, p.196]
09.45 - 10.00	**A note on hyper GR-algebras** Raymund Indangan, Gaudencio Petalcorin Mathematical Society of the Philipines [S02-CT-30, p.196]

July 29 (Fri.)	**Room: Pecatu Hall 1 and 2**
08.30 - 10.00	Chair: Aleams Barra
08.30 - 08.45	**On almost prime submodules of a finitely generated primary module over a principal ideal domain** I Gede Adhitya Wisnu Wardhana*, Pudji Astuti, Intan Muchtadi-Alamsyah Institut Teknologi Bandung, Indonesia [S02-CT-31, p.197]
08.45 - 09.00	**A note on even almost perfect numbers and related numbers** Keneth Adrian P. Dagal Far Eastern University, The Philippines [S02-CT-32, p.197]
09.00 - 09.15	**On right chain ordered semigroups** Panuwat Luangchaisri*, Thawhat Changphas Khon Kaen University [S02-CT-33, p.198]
09.15 - 09.30	**On the ideal class group of monogenic cubic fields** Eric Anthony C. Arances*, Julius M. Basilla University of the Philippines [S02-CT-34, p.198]
09.30 - 09.45	**Essential domains and Prüfer v-multiplication domains: recent developments** Marco Fontana Università degli Studi "Roma Tre", Italy [S02-CT-35, p.199]
09.45 - 10.00	**Invertiblity of some circulant matrices** Bustomi, Aleams Barra Institut Teknologi Bandung, Indonesia [S02-CT-36, p.199]

July 29 (Fri.)	**Room: Mengwi 1**
13.30 - 14.45	Chair: Yudi Mahatma
13.30 - 13.45	**Implementation of pollard rho over binary fields using brent cycle detection algorithm** Intan Muchtadi-Alamsyah*, Taufiq Akbari Utomo Institut Teknologi Bandung [S02-CT-37, p.200]
13.45 - 14.00	**The use of wallpaper-group in the development of Malay songket motif design** Riza Agustiani Universitas Islam Negeri Raden Fatah, Indonesi [S02-CT-38, p.200]
14.00 - 14.15	**The U-extension module** Yudi Mahatma*[1], Intan Muchtadi-Alamsyah[2] [1]Universitas Negeri Jakarta, Indonesia [1,2]Institut Teknologi Bandung, Indonesia [S02-CT-39, p.201]

14.15 - 14.30 **Max plus algebra and petri net application on scheduling of ship engine component′S spare part ordering**
Farah Azizah*, Subiono
Institut Teknologi Sepuluh November, Indonesia [S02-CT-40, p.201]

14.30 - 14.45 **On Euclidean and Hermitian self-dual cyclic codes over $\mathbb{F}_{2^r}$**
Odessa Consorte*, Valdez Lilibeth
University of the Philippines Diliman [S02-CT-41, p.202]

July 29 (Fri.) **Room: Pecatu Hall 1 and 2**

13.30 - 14.45 Chair: Hai Hoang Dinh

13.30 - 13.45 **Rational digit expansions of formal Laurent series over finite fields**
Manuel Joseph C. Loquias*[1], Mohamed Mkaouar[2]
Klaus Scheicher[3], Jörg M. Thuswaldner[4]
[1]University of the Philippines Diliman, [2]Faculté des Sciences de Sfax, Tunisia
[3]University of Natural Resources and Applied Life Sciences, Austria
[4]University of Leoben, Austria [S02-CT-42, p.203]

13.45 - 14.00 **On associated prime of fraction submodules over arbritrary ring**
Uha Isnaini*, Indah Emilia Wijayanti
Universitas Gadjah Mada, Indonesia [S02-CT-43, p.203]

14.00 - 14.15 **An application of IFP ring into module theory**
Hai Hoang Dinh*, Hien Truong Thi
Hong Duc University, Vietnam [S02-CT-44, p.204]

14.15 - 14.30 **Quotient structure and homomorphic properties of $S\Gamma$-semimodules over $S\Gamma$-semirings**
Shirley Mae A. Galindo*, Jr. Gaudencio C. Petalcorin[2,3]
[1]Central Mindanao University, The Philippines
[2]Mindanao State University
[3]Iligan Institute of Technology, The Philippines [S02-CT-45, p.205]

14.30 - 14.45 **On Rees algebras of linearly presented ideals: an approach via local cohomology**
Nguyen P. H. Lan
Vietnam National University, Vietnam [S02-CT-46, p.205]

Poster Session

July 26 (Tue.)	**Room: Pecatu Hall 3 and 5**
15.00 - 17.00	
15.00 - 17.00	**On (m, n)-ideals and (m, n)-regular ordered semigroups** Limpapat Bussaban, Thawhat Changphas Khon Kaen University, Thailand [S02-P-01, p.206]
15.00 - 17.00	**Algebraic properties of the multistate population matrix model** Ema Carnia*, Sisilia Sylviani, A.K. Supriatna Universitas Padjadjaran [S02-P-02, p.206]
15.00 - 17.00	**An algebraic study of the matrix meta-population model** Sisilia Sylviani*, Ema Carnia, A.K. Supriatna Universitas Padjadjaran, Indonesia [S02-P-03, p.207]
15.00 - 17.00	**Ordered semigroups containing covered one-sided ideals** Thawhat Changphas, Pisan Summaprab* Khon Kaen University [S02-P-04, p.207]
15.00 - 17.00	**A key exchange protocol using matrices over group rings** Ari Dwi Hartanto [S02-P-05, p.207]
15.00 - 17.00	**Matrix methods for bi-periodic Fibonacci and Lucas sequences** Joy P. Ascaño*, Edna N. Gueco University of the Philippines Baguio, The Philippines [S02-P-06, p.208]
15.00 - 17.00	**A continuous linear representation from topological quotient group into topological quotient vector spacel** Diah Junia Eksi Palupi Universitas Gadjah Mada, Indonesia [S02-P-07, p.208]
15.00 - 17.00	**Euclidean quadratic fields with discriminant between 500 and 1200** Vonn Kee G. Wong*, Julius M. Basilla University of the Philippines Diliman [S02-P-08, p.209]

July 27 (Wed.)	**Room: Pecatu Hall 3 and 5**
08.30 - 10.00	
08.30 - 10.00	**Linear transformation and isomorphism over max-plus algebra** M. Imran, Amir Kamal Amir, Nur Erawaty Universitas Hasanuddin, Indonesia [S02-P-09, p.209]
08.30 - 10.00	**Characteristic of $B1$ near-ring and $S1$ near-ring** Maulana Akbar, Nikken Prima Puspitar Universitas Diponegoro, Indonesia [S02-P-10, p.210]
08.30 - 10.00	**Identity based encryption using weil pairing** Najib Mubarok*, Sri Wahyuni Universitas Gadjah Mada, Indonesia [S02-P-11, p.210]
08.30 - 10.00	**On near-perfect and deficient perfect numbers with k distinct prime divisors** Carlo Francisco Adajar*, Richell Celeste University of the Philippines Diliman, The Philippines [S02-P-12, p.211]
08.30 - 10.00	**Representation of Nakayama algebra** Risnawita IAIN Bukittinggi, Indonesia [S02-P-13, p.211]
08.30 - 10.00	**Characteristics of cyclically pure injective modules** Nia Yulianti, Hanni Garminia Y. Institut Teknologi Bandung, Indonesia [S02-P-14, p.211]
08.30 - 10.00	**Certificate of positivite in Bernstein basis** Fatima Boudaoud Oran university Ahmed Benbella, Algeria [S02-P-15, p.212]

S03. Algebraic and Complex Geometry, Geometry

Invited Talks

July 26 (Tue.)	**Room: Mengwi 2**
15.00 - 16.00	Chair: Alexander H. W. Schmitt
15.00 - 15.30	**Isoperimetric inequalities on Finsler manifolds** Shin-Ichi Ohta Kyoto University, Japan [S03-IT-01, p.213]
15.30 - 16.00	**Vanishing theorems for complex projective varieties** Osamu Fujino Osaka University, Japan [S03-IT-02, p.214]

July 27 (Wed.)	**Room: Mengwi 2**
08.30 - 09.30	Chair: Juncheol Pyo
08.30 - 09.00	**Polynomial automorphisms of $\mathbf{C}^n$ preserving Markoff-Hurwitz polynomial** Hengnan Hu[1], Ser Peow Tan[1], Ying Zhang*[2] [1]National University of Singapore, [2]Suzhou University [S03-IT-03, p.215]
09.00 - 09.30	**$\mathbb{Q}$-Gorenstein deformation and its applications to algebraic surface** Yongnam Lee Korea Advanced Institute of Science and Technology [S03-IT-04, p.215]

July 28 (Thu.)	**Room: Mengwi 2**
08.30 - 09.30	Chair: Ida Kurnia W.
08.30 - 09.00	**Topology & Robotics** Michel Jambu University of Nice Sphia Antipolis, France [S03-IT-05, p.216]
09.00 - 09.30	**On geometry and topology of circular metric spaces mathematics teacher professionalism** Poom Kumam King Mongkut's University of Technology Thonburi [S03-IT-06, p.216]

Contributed Talks

July 26 (Tue.)	**Room: Mengwi 2**
16.00 - 17.00	Chair: Alexander H. W. Schmitt
16.00 - 16.15	**Star-products on functions on finite groups** Chrizaldy Neil Mañibo[1], Job A. Nable[2] [1]University of Bielefeld, [2]Ateneo De Manila University [S03-CT-01, p.217]

16.15 - 16.30	**On some curvature tensors and sectional curvatures of quasi-Einstein manifolds**	
	Dennis T. Leyson*, Richard S. Lemence	
	University of the Philippines	[S03-CT-02, p.217]
16.30 - 16.45	**Canonical foliations and submersions in paraquaternionic-like geometries**	
	Gabriel-Eduard Vîlcu	
	University of Bucharest	[S03-CT-03, p.218]
16.45 - 17.00	**Quivers and sheaves**	
	Alexander H. W. Schmitt	
	Freie Universität Berlin	[S03-CT-04, p.218]

July 27 (Wed.)	**Room: Mengwi 2**	
09.30 - 10.00	Chair: Juncheol Pyo	
09.30 - 09.45	**Rigidity theorems of hypersurfaces with free boundary in a wedge in a space form**	
	Juncheol Pyo	
	Pusan National University	[S03-CT-05, p.219]
09.45 - 10.00	**Parallel transport on S^n via generalized spherical coordinates**	
	John Gabriel P. Pelias*, Jose Maria P. Balmaceda	
	University of the Philippines-Diliman	[S03-CT-06, p.220]

July 28 (Thu.)	**Room: Mengwi 2**	
09.30 - 10.00	Chair: Ida Kurnia W.	
09.30 - 09.45	**Interpretation of Serre Swan theorem**	
	Ida Kurnia W.*, Indah Emilia W, M. Farchani Rosyid	
	Gadjah Mada University	[S03-CT-07, p.220]
09.45 - 10.00	**Structure of decoupled systems for input-output group decoupling of regular linear descriptor system with index one**	
	Arman, Ari Suparwanto, Salmah	
	Universitas Gadjah Mada, Yogyakarta	[S03-CT-08, p.221]

July 29 (Fri.)	**Room: Mengwi 2**	
08.30 - 10.00	Chair: Ohn Mar	
08.30 - 08.45	**Tori and applications of metric tensors of surfaces in 3-spheres**	
	Young Ho Kim	
	Kyungpook National University	[S03-CT-09, p.221]
08.45 - 09.00	**On the solution of a second order functional differential equation with a state derivative dependent delay**	
	J. Somsuwan*, K. M. Nakprasit	
	Khon Kaen University, Thailand	[S03-CT-10, p.222]

09.00 - 09.15 **The rigidity theorem of the catenoid and generalized Scherk's surfaces**
Daehwan Kim*, Juncheol Pyo
Pusan National University [S03-CT-11, p.222]

09.15 - 09.30 **Transversally harmonic and biharmonic maps on foliated manifolds**
Seoung Dal Jung
Jeju National University [S03-CT-12, p.223]

09.30 - 09.45 **Interaction of point vortices and a solid cylinder in a viscous fluid**
Ohn Mar
University of Mandalay [S03-CT-13, p.223]

09.45 - 10.00 **Normal families of meromorphic mappings sharing hypersurfaces**
Nguyen Thi Thu Hang
Hai Phong University, Vietnam [S03-CT-14, p.223]

Poster Session

July 26 (Tue.) **Room: Pecatu Hall 3 and 5**

15.00 - 17.00

15.00 - 17.00 **Some properties of lorentzian α-sasakian manifolds with respect to quarter-symmetric metric connection**
Santu Dey, Arindam Bhattacharyya
Jadavpur University, India [S-03-P-01, p.224]

15.00 - 17.00 **The second Hankel determinant of functions close-to-convex**
Marjono*[1], D.K. Thomas[2]
[1]University of Brawijaya, [2]Swansea University, UK [S-03-P-02, p.224]

15.00 - 17.00 **An optimization and adaptation method for arbitrary polygonal grids**
Zihuan Dai
Beijing Institute of Appl. Physics and Compt. Math. [S-03-P-03, p.225]

15.00 - 17.00 **Monocornal tilings of the hyperbolic plane**
Eduard C. Taganap*[1], Ma. Louise Antonette De Las Peñas[2]
[1]Central Luzon State University, Philippines
[2]Ateneo de Manila University, Philippines [S03-P-04, p.225]

15.00 - 17.00 **An aperiodic tiling with 6-fold rotational symmetry**
April L. D. Say-awen*[1], Ma. Louise A. N. De Las Peñas[1], Dirk Frettlöh[2]
[1]Ateneo de Manila University, Philippines
[2]Universität Bielefeld, Germany [S03-P-05, p.226]

15.00 - 17.00 **On geometric properties of q-Bézier curves**
Zhi Liu[1], Yan-Yan Lv[1], Xiao-Yan Liu*[2], Ping Jiang[1]
[1]Hefei University of Technology, China
[2]University of La Verne, USA [S03-P-06, p.227]

S04. Topology, Analysis and its Applications

Invited Talks

July 26 (Tue.)	**Room: Mengwi 3**
15.00 - 16.00	Chair: Young Whan Lee
15.00 - 15.30	**Dynamics of Hénon maps on $\mathbf{C}^n$ via pluripotential methods** Tien-Cuong Dinh National University of Singapore [S04-IT-01, p.228]
15.30 - 16.00	**Renormalized volumes and Chern Simons invariants for some noncompact hyperbolic 3 manifolds of infinite volumes** Jinsung Park Institute for Advanced Study, Korea [S04-IT-02, p.229]

July 27 (Wed.)	**Room: Mengwi 3**
	Chair: Jalina Widjaja
08.30 - 09.00	**Measures of noncompactness with certain applications** M. Mursaleen Aligarh Muslim University, India [S04-IT-03, p.229]

July 27 (Wed.)	**Room: Mengwi 3**
	Chair: Jaiok Roh
15.00 - 15.30	**Braid presentation of surface-links in 4-space** Seiichi Kamada Osaka City University, Japan [S04-IT-04, p.229]

July 28 (Thu.)	**Room: Mengwi 3**
	Chair: Dinesh Panthi
08.30 - 09.00	**The Bohr phenomenon for analytic and harmonic mappings** Rosihan M. Ali Universiti Sains Malaysia [S04-IT-05, p.230]

July 28 (Thu.)	**Room: Mengwi 3**
	Chair: Naoko Kamada
11.30 - 12.00	**A series of coefficient problems concerning the so-called Fekete-Szegö theorem** Maslina Darus Universiti Kebangsaan Malaysia [S04-IT-06, p.230]

July 28 (Thu.)	**Room: Mengwi 2**
	Chair: Vandana Tiwari
11.30 - 12.00	**Recent development of fixed point theory and optimization and its applications** Suthep Suantai Chaing Mai University, Chiang Mai, Thailand [S04-IT-07, p.231]

July 28 (Thu.)	**Room: Mengwi 3**
	Chair: Tomás Pérez Becerra
16.00 - 16.30	**Schubert calculus and cohomology of Lie groups** Haibao Duan Inst. of Math., Chinese Academy of Sciences, China [S04-IT-08, p.232]

Contributed Talks

July 26 (Tue.)	**Room: Mengwi 3**
16.00 - 17.00	Chair: Young Whan Lee
16.00 - 16.15	**Hyperstability and stability of a logarithm-type functional equation** Young Whan Lee*[1], Gwang Hui Kim[2] [1]Daejeon University, [2]Kangnam University [S04-CT-01, p.232]
16.15 - 16.30	**A new topology on the Denjoy space** Dewi Kartika Sari*, Peng-Yee Lee, Dongsheng Zhao Mathematics and Mathematics Education, NIE-NTU [S04-CT-02, p.232]
16.30 - 16.45	**Convolution theorem for two-sided quaternion linear canonical transform** Mawardi Bahri Hasanuddin University, Indonesia [S04-CT-03, p.233]
16.45 - 17.00	**Convolution and product theorems for Quaternionic fractional fourier transform** R. Roopkumar* Central University of Kerala, India [S04-CT-04, p.233]

July 27 (Wed.)	**Room: Mengwi 3**
09.00 - 10.00	Chair: Jalina Widjaja
09.00 - 09.15	**The boundedness of generalized Bessel-Riesz operators on generalized Morrey spaces** M. Idris*, H. Gunawan Institut Teknologi Bandung, Indonesia [S04-CT-05, p.234]

09.15 - 09.30 **$g^{**}\mu b$-sets in generalized fuzzy topological spaces**
Lovely B. Bacara, Helen M. Rara*
MSU-Iligan Insitute of Technology, Philippines [S04-CT-06, p.235]

09.30 - 09.45 **Itô's formula on operator-valued stochastic process**
Mhelmar A. Labendia*[1], Timothy Robin Y. Teng[2]
Elvira de Lara-Tuprio[2]
[1]MSU-Iligan Institute of Technology, Philippines
[2]Ateneo de Manila University, Philippines [S04-CT-07, p.235]

09.45 - 10.00 **Convexity of functions defined by differential inequalities and integral operators**
See Keong Lee*
Universiti Sains Malaysia [S04-CT-08, p.236]

July 27 (Wed.) **Room: Mengwi 3**

15.30 - 16.00 Chair: Jaiok Roh

15.30 - 15.45 **Possible decay rate for the solutions of the 2D Euler equations**
Jaiok Roh
Hallym University [S04-CT-09, p.237]

15.45 - 16.00 **Homogenization of some evolution problems in domains with small holes**
Bituin Cabarrubias*[1], Patrizia Donato[2]
[1]University of the Philippines Diliman, Philippines
[2]Université de Rouen, France [S04-CT-10, p.237]

July 28 (Thu.) **Room: Mengwi 3**

09.00 - 09.45 Chair: Dinesh Panthi

09.00 - 09.15 **The strong version of the countably Lipschitz integral**
Ch. Rini Indrati, Lina Aryati
Universitas Gadjah Mada, Indonesia [S04-CT-11, p.237]

09.15 - 09.30 **Bounded 2-linear functional on the n-normed spaces**
H. Batkunde*, F. Y. Rumlawang
Pattimura University, Indonesia [S04-CT-12, p.238]

09.30 - 09.45 **Some Meir-Keeler type common fixed point theorems in dislocated metric space**
Dinesh Panthi
Nepal Sanskrit University, Nepal [S04-CT-13, p.238]

09.45 - 10.00 **An approach to limit theorems for nonlinear integrals by perturbative method**
Jun Kawabe
Shinshu University, Japan [S04-CT-14, p.239]

July 28 (Thu.)	**Room: Mengwi 3**
12.00 - 12.30	Chair: Naoko Kamada
12.00 - 12.15	**Checkerboard colorable virtual knot** Naoko Kamada Nagoya City University, Japan [S04-CT-15, p.239]
12.15 - 12.30	**On statistically ϕ-convergence** Supama Gadjah Mada University, Indonesia [S04-CT-16, p.240]

July 28 (Thu.)	**Room: Mengwi 2**
12.00 - 12.30	Chair: Vandana Tiwari
12.00 - 12.15	**Nielsen fixed point theory on infra-solvmanifolds of Sol** Jang Hyun Jo, Jong Bum Lee Sogang University, Korea [S04-CT-17, p.240]
12.15 - 12.30	**On fixed point theorems for new type of φ-contraction in Menger spaces** Vandana Tiwari*, Tanmoy Som Indian Institute of Technology India [S04-CT-18, p.241]

July 28 (Thu.)	**Room: Mengwi 3**
16.30 - 17.15	Chair: Tomás Pérez Becerra
16.30 - 16.45	**The class of admissible perturbations of special expressions involving completely monotonic functions** Jerico B. Bacani*, Julius Fergy T. Rabago University of the Philippines Baguio [S04-CT-19, p.241]
16.45 - 17.00	**An integration by parts theorem for Kurzweil integrable vector-valued functions via Bochner integration** Tomás Pérez Becerra*, Juan Alberto Escamilla Reyna Benemérita Universidad Autónoma de Puebla [S04-CT-20, p.241]
17.00 - 17.15	**The *beta*-dual of the Casaro sequence spaces defined on a generalized Orlicz space** Haryadi*[1,2], Supama[2], Atok Zulijanto[2] [1]Univ. Muhammadiyah Palangkaraya [12]Universitas Gadjah Mada [S04-CT-21, p.242]

July 29 (Fri.)	**Room: Mengwi 3**
08.30 - 10.00	Chair: Jerico B. Bacani
08.30 - 08.45	**Norm equivalence for generalized Fock spaces and its application to extended Cesàro operators** Hong Rae Cho, Han-Wool Lee, Soohyun Park* National University, Pusan [S04-CT-22, p.243]

08.45 - 09.00	**Behavior of two-dimensional competitive system of nonlinear difference equations of higher order**	
	Jerico B. Bacani*, Julius Fergy T. Rabago	
	University of the Philippines Baguio	[S04-CT-23, p.243]
09.00 - 09.15	**A norm equivalence for the Fock type mixed norm**	
	Jeongmin Ha*, Hong Rae Cho, Han-Wool Lee	
	Pusan National University	[S04-CT-24, p.244]
09.15 - 09.30	**Characterizations of sequence of fractional integrable functions**	
	Riyadi, Mardiyana	
	Sebelas Maret University	[S04-CT-25, p.244]
09.30 - 09.45	**On zweier paranorm i-convergent double sequence spaces**	
	Nazneen Khan	
	Aligarh Muslim University, Aligarh, India	[S04-CT-26, p.244]
09.45 - 10.00	**An inclusion property of Orlicz-Morrey spaces**	
	Al Azhary Masta*, Hendra Gunawan, Wono Setya Budhi	
	Institut Teknologi Bandung, Indonesia	[S04-CT-27, p.245]

Poster Session

July 26 (Tue.) **Room: Pecatu Hall 3 and 5**

15.00 - 17.00

15.00 - 17.00	**On existence of coincidence and common fixed point for hybrid maps**	
	Anita Tomar	
	Government P. G. College Dakpathar Uttarakhand	[S04-P-01, p.245]
15.00 - 17.00	**q-Sumudu transforms of basic generalized hypergeometric functions**	
	V. K. Vyas, Rajshree Purohit	
	The ICFAI University Jaipur, India	[S04-P-02, p.246]
15.00 - 17.00	**On some sequence spaces by using the $(\bar{N}, P_n)$ summability method**	
	T. A. Chishti*	
	University of Kashmir	[S04-P-03, p.246]
15.00 - 17.00	**Lipschitz conditions and the controlled convergence theorem**	
	Julius V. Benitez, Sandy Mae S. Docdoc	
	MSU-Iligan Institute of Technology, Philippines	[S04-P-04, p.246]
15.00 - 17.00	**Some hyperbolic classes of analytic functions in the unit disk**	
	Luis Manuel Tovar	
	ESFM; Instituto Politecnico Nacional	[S04-P-05, p.247]

15.00 - 17.00	**Ramanujan's beautiful results on hypergeometric series and their generalizations** Arjun Kumar Rathie Central University of Kerala, Tejaswini Hills, India	[S04-P-06, p.247]
15.00 - 17.00	**A grüss type integral inequality associated with pathway fractional integral operator** Sunil Dutt Purohit Rajasthan Technical University, India	[S04-P-07, p.248]

July 27 (Wed.) **Room: Pecatu Hall 3 and 5**

08.30 - 10.00

08.30 - 10.00	**Certain new integral inequalities involving Erdélyi-Kober operator** Naresh Menaria Pacific college of Engineering, India	[S04-P-08, p.248]
08.30 - 10.00	**Brans-Dicke theory in Gödel type space-time** A. M. Mishra Rajasthan Technical University Kota, India	[S04-P-09, p.249]
08.30 - 10.00	**A weak-(p, q) estimate for fractional integral operator on generalized Morrey spaces of nonhomogeneous type** Idha Sihwaningrum Jenderal Soedirman University, Indonesia	[S04-P-10, p.249]
08.30 - 10.00	**Bounds for approximate time and frequency concentration** Louie John Vallejo University of the Philippines - Diliman	[S04-P-11, p.249]
08.30 - 10.00	**Ricci solitons on three-dimensional generalized sasakian -space-forms** Shyamal Hui[1], Debabrata Chakraborty[2] Richard Lemence[3] [1]Bankura University, India [2]Petadih Hirakhap Jr. High School, India [3]University of the Philippines-Diliman	[S04-P-12, p.250]
08.30 - 10.00	**Extended Srivastava's triple hypergeometric functions and associated properties** Rakesh K. Parmar Govt. College of Engineering and Technology, India	[S04-P-13, p.250]
08.30 - 10.00	**Constructing localized frames adapted to a cover of the time-frequency plane** Gino Angelo Velasco[1], Monika Dörfler[2] [1]University of the Philippines Diliman, Philippines [2]University of Vienna, Austria	[S04-P-14, p.251]

S05. Dynamical Systems and Ordinary Differential Equations

Invited Talks

July 26 (Tue.) — **Room: Mengwi 5**

Chair: Shin-Hwa Wang

15.00 - 15.30 **A spectral theory of linear operators based on a Gelfand triplet and its application to the dynamics of coupled oscillators**

Hayato Chiba
Kyushu University, Japan [S05-IT-01, p.252]

July 27 (Wed.) — **Room: Mengwi 5**

Chair: Windarto

08.30 - 09.00 **Asymptotic stability of linear fractional differential systems with constant coefficients and small time dependent perturbations**

Dinh Cong Nguyen*, Thai Son Doan, The Tuan Hoang
Institute of Mathematics, Vietnam Academy of Science and Technology
Cau Giay District, 10307 Hanoi, Vietnam [S05-IT-02, p.252]

July 27 (Wed.) — **Room: Mengwi 5**

Chair: Dhiah Wardani

15.00 - 15.30 **Dynamic behavior of SIR model perturbed by noise**

N. H. Du*[1], N.H. Dang[1], N. T. Dieu[2]
[1]VNU-Hanoi University of Science, [2]Vinh University [S05-IT-03, p.253]

July 27 (Wed.) — **Room: Mengwi 2**

Chair: D. Aldila

15.00 - 15.30 **Closed orbit counting for dyck and motzkin shifts**

Mohd S. Md Noorani*[1] , Fahad Alsharari[1], Habibulla Akhadkulov[2]
[1]Universiti Kebangsaan Malaysia
[2]Universiti Utara Malaysia [S05-IT-04, p.254]

July 28 (Thu.) — **Room: Mengwi 5**

Chair: Hengki Tasman

11.30 - 12.00 **Quantum calculus and applications**

Jessada Tariboon
King Mongkut's Univ. of Technology North Bangkok [S05-IT-05, p.254]

July 28 (Thu.) **Room: Mengwi 5**

Chair: Nur Izzati Khairudin

16.00 - 16.30 **Unique solvability of nonlinear partial differential equations of Fuchs type**
Jose Ernie C. Lope
University of the Philippines Diliman [S05-IT-06, p.255]

July 28 (Thu.) **Room: Mengwi 2**

Chair: Jinsil Lee

16.00 - 16.30 **Analysis of an influenza model with antigenic drift mechanism and the interaction between human and animal population**
Fajar Adi Kusumo*[1], Dessy Nurul[1], Muhammad Kharis[2]
[1]Universitas Gadjah Mada
[2]Semarang State University, Indonesia [S05-IT-07, p.255]

Contributed Talks

July 26 (Tue.) **Room: Mengwi 5**

15.30 - 17.00 Chair: Shin-Hwa Wang

15.30 - 15.45 **On the solution of parameterized second-order boundary value singularly perturbed problem**
Ilhame Amirali*[1] and Gabil M. Amiraliyev[2]
[1]Duzce University, Turkey
[2]Erzincan University, Turkey [S05-CT-01, p.256]

15.45 - 16.00 **Exact multiplicity and bifurcation curves of positive solutions of a one-dimensional Minkowski-curvature problem and its application**
Shao-Yuan Huang
University Hsinchu 300, Taiwan [S05-CT-02, p.256]

16.00 - 16.15 **Symmetric solutions in delay-coupled laser networks with all-to-all coupling**
Juancho A. Collera
University of the Philippines Baguio [S05-CT-03, p.257]

16.15 - 16.30 **Washout and non-washout solutions of a microbial fermentation model under the influences of growth inhibitions and maximal cell density**
Kasbawati*[1], Agus Yodi Gunawan[2], Kuntjoro Adjie Sidarto[2]
[1]Hasanuddin University, Indonesia
[2]Institut Teknologi Bandung [S05-CT-04, p.257]

16.30 - 16.45 **Social and economic influences on human behavioural response in an emerging epidemic**
Piau Phang*[1,2], Yong-Hong Wu[1], Benchawan Wiwatanapataphee[1]
[1]Curtin University, Perth, Australia
[2]Universiti Malaysia Sarawak, Malaysia [S05-CT-05, p.258]

16.45 - 17.00 **Evolutionary bifurcation curves for the one-dimensional perturbed Gelfand problem from combustion theory and a variational property**
Shin-Hwa Wang, Shao-Yuan Huang
National Tsing Hua University, Hsinchu 300, Taiwan [S05-CT-06, p.259]

July 27 (Wed.) **Room: Mengwi 5**

09.00 - 10.00 Chair: Windarto

09.00 - 09.15 **Existence of maximal bounded attractor for the Lorenz system**
Naimah Aris*, Jihan Fazlika and Agustinus Ribal
Hasanuddin University, Indonesia [S05-CT-07, p.259]

09.15 - 09.30 **Topological entropy and its application on the entropy of DNA sequences**
Widodo
Gadjah Mada University, Indonesia [S05-CT-08, p.260]

09.30 - 09.45 **Dynamical analysis of a delayed SIR epidemic model with vaccination**
Trisilowati*, I. Darti and S. Fitri
Brawijaya University, Indonesia [S05-CT-09, p.261]

09.45 - 10.00 **On global stability of equilibria of HIV spread mathematical model among injecting drug users including methadon therapy**
Windarto
Universitas Airlangga, Indonesia [S05-CT-10, p.261]

July 27 (Wed.) **Room: Mengwi 5**

15.30 - 16.00 Chair: Dhiah Wardani

15.30 - 15.45 **Fractal analysis to classify heart sound recordings (phonocardiogram) using Higuchi algorithm**
Dhiah Wardani, Dwi Juniati
Universitas Negeri Surabaya [S05-CT-11, p.262]

16.45 - 17.00 **Controlling spatial spreading of MERS disease with medical support**
S. Rozi*[1,2], D. Aldila[1], H. Tasman[1]
[1]Universitas Indonesia
[2]STIKOM Dinamika Bangsa, Jambi [S05-CT-12, p.262]

July 27 (Wed.)	**Room: Mengwi 2**
15.30 - 16.00	Chair: D. Aldila
15.30 - 15.45	**Relation between mosquito behavior and malaria transmission dynamics** Sungchan Kim*, Giphil Cho and Il Hyo Jung Pusan National University, Korea [S05-CT-13, p.263]
15.45 - 16.00	**Dynamical study for dengue epidemiological model: an analysis of intervention** D. Aldila* and A. Yuwanda Universitas Indonesia [S05-CT-14, p.263]

July 28 (Thu.)	**Room: Mengwi 5**
12.00 - 12.30	Chair: Hengki Tasman
12.00 - 12.15	**ODE and SDE model of cancer viral therapy: how do we avoid failure of cancer viral therapy?** Kwang Su Kim*[1], Il Hyo Jung[1] and Sangil Kim[2] [1]Pusan National University, South Korea [2]Hankuk University of Foreign Studies, South Korea [S05-CT-15, p.264]
12.15 - 12.30	**Analysis of a model of the spread of radical ideology with some results of rehabilitation program** Hengki Tasman* and Bevina D. Handari Universitas Indonesia [S05-CT-16, p.265]

July 28 (Thu.)	**Room: Mengwi 5**
16.30 - 17.30	Chair: Nur Izzati Khairudin
16.30 - 16.45	**Dynamic of SIR-E rotavirus epidemic model** Isnani Darti*, Agus Suryanto and Trisilowati Brawijaya University, Indonesia [S05-CT-17, p.265]
16.45 - 17.00	**The stability of the dispersionless complex Swift-Hohenberg equation** Nur Izzati Khairudin*, Farah Aini Abdullah, Yahya Abu Hasan Universiti Sains Malaysia [S05-CT-18, p.266]
17.00 - 17.15	**Moment analysis of the stochastic Morris-Lecar neuron with additive noise** Syed M. Raza Shah Naqvi* and Hyun Min Kim Pusan National University, Busan, South Korea [S05-CT-19, p.266]
17.15 - 17.30	**A mathematical model of transmission of rice tungro disease by nephotettix virescens** Nikki T. Blas*[1], Joel M. Addawe[2] and Guido David[1] [1]University of the Philippines - Diliman [2]University of the Philippines - Baguio [S05-CT-20, p.267]

July 28 (Thu.) **Room: Mengwi 2**

16.30 - 17.30 Chair: Jinsil Lee

16.30 - 16.45 **Direction of Hopf bifurcation for a predator-prey model with Dtwo time delays**
May Anne C. Tirado*[1], Polly W. Sy[1], Lorna S. Almocera[2]
[1]University of the Philippines - Diliman
[2]University of the Philippines - Cebu [S05-CT-21, p.267]

15.45 - 16.00 **The dynamical system of a bank using interbank lending**
Novriana Sumarti* and Akmal Fadhlurrahman
Institut Teknologi Bandung, Indonesia [S05-CT-22, p.268]

17.00 - 17.15 **New delay-range-dependent stability criteria for linear system with non-differentiable interval time-varying delay and nonlinear perturbations**
Presarin Tangsiridamrong*, Kanit Mukdasai
Khon Kaen University, Thailand [S05-CT-23, p.268]

17.15 - 17.30 **Existence of positive solutions for nonlinear fractional differential equations**
Jinsil Lee*, Yong-Hoon Lee
Pusan National University [S05-CT-24, p.269]

July 29 (Fri.) **Room: Mengwi 5**

08.30 - 10.00 Chair: Endar H. Nugrahani

08.30 - 08.45 **Imploding cylindrical and spherical shock waves in a non-ideal gas**
Amit Tomar[1], Rajan Arora[2], V.P. Singh[3]
[1]Amity University Noida, India, [2]Indian Institute of Technology Roorkee
[3]Al- Baha university, Al- Baha Saudi Arabia, KSA [S05-CT-25, p.269]

08.45 - 09.00 **Limiting behavior in a five-species chemostat model with parasitic fung**
Alexis Erich S. Almocera*[1], Sze-Bi Hsu[2], Polly W. Sy[1]
[1]University of the Philippines Diliman
[2]National Tsing Hua University, Taiwan [S05-CT-26, p.270]

09.00 - 09.15 **New approach for the existence of global attractor in the Lorenz system**
Naimah Aris
Hasanuddin University, Indonesia [S05-CT-27, p.270]

09.15 - 09.30 **Multi-step method for solving singular integro-differential equations and their applications**
M.V.Bulatov[1], D.T.Thanh[2]
[1]Irkutsk State Technical University, Russian Federation
[2]Vietnamese Military Medical University [S05-CT-28, p.271]

09.30 - 09.45 **Model of vehicles queuing at the signalized intersection**
Tomi Tristono*[1], M. Sidqon[2]
[1]Universitas Merdeka Madiun
[2]Universitas 17 Agustus 1945 Surabaya [S05-CT-29, p.272]

09.45 - 10.00 **Dynamical modeling of dissolved oxygen level in water body with eutrophication**
Endar H. Nugrahani*[1], Sri L. Mahmud[2], Paian Sianturi[1]
[1]Bogor Agricultural University, Indonesia
[2]Gorontalo State University, Indonesia [S05-CT-30, p.272]

July 29 (Fri.) **Room: Mengwi 5**

13.30 - 14.45 Chair: Okosun K. O.

13.30 - 13.45 **Dynamics of stage-structured prey-predator model with Crowley-Martin functional response**
Sumit Kaur Bhatia, Sudipa Chauhan, Apurva Agarwal*
AIAS, Amity University, U.P,India [S05-CT-31, p.273]

13.45 - 14.00 **Analysis of a modified Leslie-Gower predator-prey model with Crowley-Martin functional response and prey refuge**
Jai Prakash Tripathi
Central University of Rajasthan, India [S05-CT-32, p.273]

14.00 - 14.15 **On the dynamics of malaria-cholera co-infection under climate variability**
Okosun K. O.[1], Abiodun G.J[2]
[1]Vaal University of Technology, South Africa
[2]University of the Western Cape, South Africa [S05-CT-33, p.274]

14.15 - 14.30 **Application of the homotopy method for solving interaction model of the immune system with HIV**
Embay Rohaeti*, Ani Andriyati, Prasetyorini, Amar Sumarsa
Pakuan University [S05-CT-34, p.274]

July 29 (Fri.) **Room: Mengwi 2**

13.30 - 15.00 Chair: Norhaslinda Zainal Abidin

13.30 - 13.45 **Dynamical system of tuberculosis spread model with two groups of infected population**
Vina Apriliani*, Jaharuddin
Bogor Agricultural University, Indonesia [S05-CT-35, p.275]

13.45 - 14.00 **Stage-structured prey-predator model with maturation delay for prey and gestation delay for predator with holling type-ii functional response**
Sudipa Chauhan[1], Joydip Dhar[2], Vandana Kumari*[1], Sumit Kaur Bhatia[1]
[1]AIAS, Amity University, U.P, India
[2]ABV-IIITM, Gwalior, M.P [S05-CT-36, p.275]

14.00 - 14.15 **Stability analysis and mathematical modeling of pomfret and tiger grouper's growth on integrated multi-trophic aquaculture systems**
Ririn S*[1], Widowati[1], Sapto P. Putro[2]
Diponegoro University [S05-CT-37, p.276]

14.15 - 14.30 **Dynamics of dengue transmission model in Baguio City, Philippines**
Joel Addawe*[1], Donnabel Tubera[2], Aprimelle Kris Pajimola[1]
[1]University of the Philippines Baguioa
[2]Donnabel Tubera, Health Services Office, Baguio City [S05-CT-38, p.276]

14.30 - 14.45 **MERS epidemic model analysis with various interventions**
H. Padma*, D. Aldila, H. Tasman, K. Khotimah
Univesitas Indonesi [S05-CT-39, p.277]

14.30 - 14.45 **Towards improvising Malaysia palm oil production: dynamic hypothesis for dynamic simulation model development**
M Faeid M Zabid, Norhaslinda Zainal Abidin*, Shri-Dewi Applanaidu
Universiti Utara Malaysia [S05-CT-40, p.277]

Poster Session

July 27 (Wed.) **Room: Pecatu Hall 3 and 5**

15.00 - 16.00

15.00 - 16.00 **New delay-range-dependent exponential stability criteria of impulsive switched linear system with mixed interval non-differentiable time-varying delays and nonlinear perturbations**
Kanit Mukdasai
Khon Kaen University, Thailand [S05-P-01, p.278]

15.00 - 16.00 **Linearisation of a sequence of holomorphic contractions**
Guitta Sabiini Rishmany
Notre Dame University Louaize-Lebanon [S05-P-02, p.278]

15.00 - 16.00 **Mathematical model of AKT phosporylation in presence of competitif inhibitor**
Y. A. Adi*[1], F. Adi-Kusumo[2], L. Aryati[2], M.S. Hardianti[2]
[1]Universitas Ahmad Dahlan
[1]Universitas Gadjah Mada [S05-P-03, p.279]

15.00 - 16.00 **Nonlinear IS-LM business cycle model with time delays in capital accumulation**
Endar H Nugrahani*, Rosmely and Paian Sianturi
Bogor Agricultural University [S05-P-04, p.279]

15.00 - 16.00 **A cellular mathematical model of nasopharyngeal carcinoma with functional response and logistic function**
Sugiyanto*, F. Adi-Kusumo, L. Aryati, M. S. Hardianti
Universitas Gadjah Mada, Yogyakarta [S05-P-05, p.280]

15.00 - 16.00 **On the fast escaping set of transcendental semigroups**
Bishnu Hari Subedi*, Ajaya Singh
Tribhuvan University, Kathmandu, Nepal [S05-P-06, p.280]

July 28 (Tue.) **Room: Pecatu Hall 3 and 5**

08.30 - 10.00

08.30 - 10.00 **Global stability of SACR epidemic model for hepatitis C on injection drug users**
Dwi Lestari, Lidyana Candrawati
Yogyakarta State University, Indonesia [S05-P-07, p.280]

08.30 - 10.00 **Effect of a small insoluble surfactant concentration on the shape of a steady sessile drop: numerical and asymptotic approaches**
K. Yulianti*[1], A. Y. Gunawan[2], E. Soewono[2] and L. Mucharam[2]
[1]Universitas Pendidikan Indonesia
[2]Institut Teknologi Bandung [S05-P-08, p.281]

08.30 - 10.00 **A dengue transmission model: dynamics and control**
Jose Maria L. Escaner IV* and Aurelio A. de los Reyes V
University of the Philippines Diliman [S05-P-09, p.281]

08.30 - 10.00 **Simulation for the mathematical model of infection HPV on cervical cancer**
Tri Sri Noor Asih*[1], Lina Aryati[2]
Fajar Adi Kusumo[2], Mardiah S. Hardianti[2]
[1]Semarang State University
[1]Gadjah Mada University [S05-P-10, p.282]

08.30 - 10.00 **State characterization in model order reduction for estimation process**
Didik Khusnul Arif, Dieky Adzkiya, Erna Apriliani
Institut Teknologi Sepuluh Nopember [S05-P-11, p.282]

08.30 - 10.00 **Dynamical analysis of a fractional order modified Leslie-gower predator-prey model with beddington-deangelis functional** response
Agus Suryanto*, Isnani Darti, Syaiful Anam
Brawijaya University, Indonesia [S05-P-12, p.283]

July 28 (Tue.)	**Room: Pecatu Hall 3 and 5**
16.00 - 17.30	
16.00 - 17.30	**Solutions of fractional differential equations in form Mittag-Lefler function and its application in viscoelasticity** Endang Rusyaman*, Kankan Parmikanti Universitas Padjadjaran [S05-P-13, p.283]
16.00 - 17.30	**Fractal analysis of retinal image using box-counting fractal dimension to recognition of diabetic retinopathy** Diah Safitri, Dwi Juniati Universitas Negeri Surabaya [S05-P-14, p.284]
16.00 - 17.30	**Discretization of Mathematical Model of Immune System and Mycobacterium Tuberculosis Interaction** Usman Pagalay, Wahyuni Fitria Aprilia Wati, Wahyu H. Irawan Maulana Malik Ibrahim State Islamic University [S05-P-15, p.285]
16.00 - 17.30	**Optimal control of host-vector model using pontryagin minimum principle** Eminugroho Ratna Yogyakarta State University, Indonesia [S05-P-16, p.285]
16.00 - 17.30	**Asymptotic properties of the sample codifference function of ma(q) process with infinite variance** Iqbal Kharisudin[1], Dedi Rosadi[1], Abdurakhman[1], Suhartono[2] [1]Gadjah Mada University [2]Institut Teknologi Sepuluh Nopember [S05-P-17, p.286]
16.00 - 17.30	**Some elements of the behavior around the infinite poles** Gantina Rachmaputri Institut Teknologi Bandung [S05-P-18, p.286]

S06. Partial Differential Equations

Invited Talks

July 26 (Tue.)	**Room: Mengwi 6**
	Chair: L. H. Wiryanto
15.00 - 15.30	**Tornado on Potter's invisibility cloak: nonlinear waves in metamaterials** Hadi Susanto University of Essex [S06-IT-01, p.287]

July 27 (Wed.)	**Room: Mengwi 6**
	Chair: Rajan Arora
15.00 - 15.30	**Two-phase flows with phase transitions** Senjo Shimizu Kyoto University, Japan [S06-IT-02, p.287]

July 28 (Thu.)	**Room: Mengwi 6**
	Chair: Randy L. Caga-Anan
08.30 - 09.00	**Multiscale methods and analysis for the nonlinear Klein-Gordon equation in the nonrelativistic limit regime** Weizhu Bao National University of Singapore [S06-IT-03, p.288]

July 28 (Thu.)	**Room: Mengwi 6**
	Chair: Dadang Amir Hamzah
11.30 - 12.00	**Nonlinear elliptic systems with mixed attractive and repulsive interactions** Jaeyoung Byeon KAIST, Korea [S06-IT-04, p.288]

Contributed Talks

July 26 (Tue.)	**Room: Mengwi 6**
15.30 - 17.00	Chair: L. H. Wiryanto
15.30 - 15.45	**Fluid-structured coupled wave scattering of waveguides with abrupt changes in height** Rab Nawaz COMSATS Inst. of Information Technology, Pakistan [S06-CT-01, p.289]

15.45 - 16.00 **A semigroup theoretic approach to a semilinear diffusive equation with time delay and impulse**
Cece Kustiawan*, Jalina Widjaja and Yudi Soeharyadi
Institut Teknologi Bandung, Indonesia [S06-CT-02, p.289]

16.00 - 16.15 **Amplitude dynamics of soliton sequences of perturbed coupled nonlinear Schrödinger equations**
Quan M. Nguyen*[1], Avner Peleg[2] and Toan T. Huynh[3]
[1]Vietnam National University-HCMC, Vietnam
[2]Afeka College of Engineering, Tel Aviv, Israel
[3]University of Medicine and Pharmacy, Vietnam [S06-CT-03, p.290]

16.15 - 16.30 **Boussinesq equations as a model of wave generation**
L. H. Wiryanto*[1], Sudi Mungkasi[2]
[1]Institut Teknologi Bandung
[2]University Sanata Dharma, Yogyakarta [S06-CT-04, p.290]

16.30 - 16.45 **Image enlargement using partial differential equation with positivity preserving cubic said-ball curves boundary condition**
Azizan Saaban[1], Ahmad Saleh Abdulah Kherd[2]
[1]Universiti Utara Malaysia
[2]Yemen Al-Ahgaff University [S06-CT-05, p.291]

16.45 - 17.00 **Deformation of bichromatic wave groups based on third order side band solution of Benjamin bona mahony equation**
Marwan Ramli*, Vera Halfiani
Syiah Kuala University Banda Aceh [S06-CT-06, p.291]

July 27 (Wed.) **Room: Mengwi 6**

15.30 - 16.00 Chair: Rajan Arora

15.30 - 15.45 **Biharmonic on annulus with polynomial data**
Ikhsan Maulidi*1 and Agah D Garnadi[2]
[1]Sumatera Technology Institute, Indonesia
[2]Bogor Agricultural University, Indonesia [S06-CT-07, p.292]

15.45 - 16.00 **Analytical and numerical solutions of some non-linear PDEs by HAM**
Rajan Arora*, Ankita Sharma
Indian Institute of Technology Roorkee, India [S06-CT-08, p.292]

July 28 (Thu.) **Room: Mengwi 6**

09.00 - 09.45 Chair: Randy L. Caga-Anan

09.00 - 09.15 **Propagation of blast wave problem in a non-ideal gas**
Rajan Arora*[1], Sanjay Yadav[2]
[1]IIT Roorkee India
[2]The Northcap Univesity Gurgaon Haryana India [S06-CT-09, p.293]

09.15 - 09.30 **Certain nonlinear singular partial differential equations in the ultradifferentiable class**
Randy L. Caga-Anan*[1], Jose Ernie C. Lope[2]
[1]Mindanao State University-IIT, Philippines
[2]University of the Philippines-Diliman [S06-CT-10, p.293]

09.30 - 09.45 **On the numerical solution of Fisher equation by iterative splitting method**
Hamzah, D. A., Tuwankotta, J. M., Soeharyadi, Y.
Intstitut Teknologi Bandung [S06-CT-11, p.294]

July 28 (Thu.) **Room: Mengwi 6**

12.00 - 12.30 Chair: Dadang Amir Hamzah

12.00 - 12.15 **Nonlinear biharmonic problem with fully nonlinear term**
Q-Heung Choi*[1], Tacksun Jung[2]
[1]Inha University, Korea
[2]Kunsan National University, Korea [S06-CT-12, p.294]

12.15 - 12.30 **Multiple solutions for the Hamiltonian system with singular nonlinear term**
Tacksun Jung*[1], Q-Heung Choi[2]
[1]Kunsan National University, Korea
[2]Inha University, Korea [S06-CT-13, p.295]

July 29 (Fri.) **Room: Mengwi 5**

14.30 - 15.00 Chair: Okosun K. O.

14.30 - 14.45 **Heat transfer in MHD flow of carbon nanotubes suspended nanofluid over a stretching sheet**
Abid Hussanan*[1], Mohd Zuki Salleh[1] and Ilyas Khan[2]
[1]Universiti Malaysia Pahang, Malaysia
[2]Majmaah University, Saudi Arabia [S06-CT-14, p.296]

14.45 - 15.00 **On Lax-Oleinik type formula for multi-time conservation laws**
Nguyen Huu Tho
Thuy Loi University Hanoi, Vietnam [S06-CT-15, p.296]

Poster Session

July 28 (Thu.) **Room: Pecatu Hall 3 and 5**

16.00 - 17.30

16.00 - 17.30 **Parametrized perturbation results on global positive solutions for elliptic equations involving critical sobolev-hardy exponents and hardy terems**
Wan Se Kim
Hanyang University, Korea [S06-P-01, p.297]

16.00 - 17.30 **Pricing American down-and-out call option using Fourier transform**
Dewi Mashitasari* and Endah Rokhmati MP
Sepuluh Nopember Institute of Technology, Indonesia [S06-P-02, p.297]

16.00 - 17.30 **Comparison of binomial method and laplace on American put option as an investment of a life insurance participating policies endowment type**
Hermei Lissa*, Endah R.M. Putri
Sepuluh Nopember Institute of Technology Surabaya [S06-P-03, p.297]

16.00 - 17.30 **The distinction of asymptotic behaviour optimal stock prece American call option and stock loan**
Noviana Tri Utami*, Endah R. M. Putri
Sepuluh Nopember Institute of Technology Surabaya [S06-P-04, p.298]

16.00 - 17.30 **A study of cylindrical shock wave in magnetogasdynamics using similarity method**
Hariom Sharma*, Rajan Arora
Indian Institute of Technology Roorkee, India [S06-P-05, p.298]

16.00 - 17.30 **A variational method for volume-preserving multiphase mean curvature flow considering bulk energies**
Rhudaina Z. Mohammad*
Western Mindanao State University, Philippines [S06-P-06, p.299]

16.00 - 17.30 **On the properties of some fractional derivatives and some applications**
Ramon Vicente R. Agcaoili, Johnatan S. Pimentel
Marian P. Roque*
University of the Philippines Diliman [S06-P-07, p.300]

S07. Probability and Statistics

Invited Talks

July 26 (Tue.) — **Room: Mengwi 7**

Chair: Mohammad Masjkur

15.00 - 15.30 **Weighted L^2-statistics for testing goodness-of-fit**
Ludwig Baringhaus, Bruno Ebner, Norbert Henze*
Universität Hannover [S07-IT-01, p.301]

July 27 (Wed.) — **Room: Mengwi 7**

Chair: I Wayan Sumarjaya

08.30 - 09.00 **Bernstein reciprocal processes, their origin and uses in Mathematics, Natural Sciences and other fields**
Jean-Claude Zambrini
Group of Mathematical Physics Univ. Lisbon. [S07-IT-02, p.302]

July 27 (Wed.) — **Room: Mengwi 7**

Chair: M. Fathurahman

15.00 - 15.30 **Navier-Stokes equation and stochastic forward-backward systems**
Xin Chen[1], Ana Bela Cruzeiro*[2], Zhongmin Qian[3]
[1]Shanghai Jiao Tong University, China
[2]University Lisbon, Portugal
[3]University Oxford, UK [S07-IT-03, p.302]

July 28 (Thu.) — **Room: Mengwi 7**

Chair: Herry Pribawanto Suryawan

08.30 - 09.00 **Stochastic dynamics in infinite dimensions related to random matrices**
Hirofumi Osada
Kyushu University, Japan [S07-IT-04, p.302]

09.00 - 09.30 **Estimating the intensity of a cyclic Poisson process in the presence of linear, quadratic and power function trends**
I Wayan Mangku
Bogor Agricultural University [S07-IT-05, p.303]

July 28 (Thu.)	**Room: Mengwi 7**
	Chair: Komang Dharmawan
11.30 - 12.30	**Bounds in total variation distance for Markov chains and random walks**
	Ian Flint, Nicolas Privault*, Giovanni Luca Torrisi
	Nanyang Technological University, CNR Rome [S07-IT-06, p.304]

July 28 (Thu.)	**Room: Mengwi 7**
	Chair: Heri Kuswanto
16.00 - 16.30	**Dense and sparse graph limits arising from respondent driven sampling**
	Adrian Röllin
	National University of Singapore [S07-IT-07, p.304]

July 28 (Thu.)	**Room: Legian 1**
	Chair: I Gede Nyoman Mindra Jaya
16.00 - 16.30	**The motion of a tagged particle in the simple exclusion process**
	Dayue Chen
	Peking University, China [S07-IT-08, p.305]

Contributed Talks

July 26 (Tue.)	**Room: Mengwi 7**
15.30 - 17.00	Chair: Mohammad Masjkur
15.30 - 15.45	**Bayesian estimation of random parameter response models of skew-normally distributed stimuli: evidence from Monte Carlo simulation**
	Mohammad Masjkur*[1], Henk Folmer[2]
	[1]Bogor Agricultural University, Indonesia
	[2]University of Groningen, The Netherlands [S07-CT-01, p.305]
15.45 - 16.00	**Estimating DEA efficiency using uniform distribution**
	MD. Kamrul Hossain[1], Anton Abdullah Kamil*[2]
	Universiti Sains Malaysia, Penang [S07-CT-02, p.306]
16.00 - 16.15	**Wavelet recurrent neuro fuzzy for time series forecasting model**
	Nanang Hermawan*[1], Dedi Rosadi[2]
	Gadjah Mada University, Indonesia [S07-CT-03, p.307]

16.15 - 16.30	**Construction an isometric stochastic flows on Gromoll-Meyer exotic sphere** Nurfarisha*, Adhitya Ronnie Effendie, Muhammad Farchani Rosyid Universitas Gadjah Mada, Yogyakarta [S07-CT-04, p.307]
16.30 - 16.45	**Survival regression analysis of networked infectious data** Oyelola A. Adegboye Qatar University, Doha [S07-CT-05, p.308]
16.45 - 17.00	**A new approach in constructing spatial dependence of space time series through an adjacency matrix** Utriweni Mukhaiyar Institut Teknologi Bandung, Indonesia [S07-CT-06, p.308]

July 27 (Wed.) **Room: Mengwi 7**

09.00 - 10.00 Chair: I Wayan Sumarjaya

09.00 - 09.15	**Infrastructure of transportation and communication as a basic estimation of quality of life in urban area (case study in Central Java Province)** Sri Subanti*[1], Inaki Maulida Hakim[2], Arif Rahman Hakim[1,2] [1]Sebelas Maret University, [2]University of Indonesia [S07-CT-07, p.309]
09.15 - 09.30	**Change of scale formulas for conditional Fourier-Feynman transforms over continuous paths II** Dong Hyun Cho Kyonggi University, Republic of Korea [S07-CT-08, p.309]
09.30 - 09.45	**Model spatial disease mapping with under reported data (multiple approach)** S. Padmadisastra*, J. Suprijadi, N. Sunengsih Universitas Padjadjaran, Indonesia [S07-CT-09, p.310]
09.45 - 10.00	**A survey of kernel-type estimators for copulas and their applications** I Wayan Sumarjaya Udayana University, Indonesia [S07-CT-10, p.310]

July 27 (Wed.) **Room: Mengwi 6**

09.00 - 10.00 Chair: A. I. Endrayanto

09.00 - 09.15	**Kalman filter for better forecasting** Erna Apriliani, Endah Putri, Nuri Wahyuniningsih Institut Teknologi Sepuluh Nopember, Indonesia [S07-CT-11, p.311]
09.15 - 09.30	**A bivariate approach in modeling two-dimensional warranty with imperfect preventive maintenance** Hutomo A. Maulana*[1], Udjianna S. Pasaribu[1], Hennie Husniah[2] [1]Institut Teknologi Bandung, Indonesia [2]Langlangbuana University, Indonesia [S07-CT-12, p.312]

09.30 - 09.45 **A multi item probabilistic inventory model**
Dharma Lesmono, Taufik Limansyah
Universitas Katolik Parahyangan [S07-CT-13, p.312]

09.45 - 10.00 **Overflow loss system analysis for optimal bed allocation in a hospital in Yogyakarta Indonesia**
A. I. Endrayanto[1], Gunardi[1], F. Adi Kusumo[1]
R.J. Boucherie[2], N.M. van de Vrugt[2]
[1]Universitas Gadjah Mada, Yogyakarta, Indonesia
[2]University of Twente, Enschede, the Netherlands [S07-CT-14, p.313]

July 27 (Wed.) **Room: Mengwi 7**

15.30 - 16.00 Chair: M. Fathurahman

15.30 - 15.45 **Bivariate logistic regression modeling**
M. Fathurahman*[1,2], Purhadi[1], Sutikno[1], Vita Ratnasari[1]
[1]Institut Teknologi Sepuluh Nopember, Indonesia
[2]University of Mulawarman Samarinda, Indonesia [S07-CT-15, p.313]

15.45 - 16.00 **Application of universal kriging for predicting coal ash content using GStat R**
Annisa Nur Falah, Betty Subartini, Budi Nurani Ruchjana*
Universitas Padjadjaran, Indonesia [S07-CT-16, p.314]

July 28 (Thu.) **Room: Mengwi 7**

09.30 - 10.00 Chair: Herry Pribawanto Suryawan

09.30 - 09.45 **Parameter estimation of exponentiated modified Weibull extension distribution**
Christian Beren*, Sri Astuti Thamrin, Andi Kresna Jaya
Hasanuddin University, Indonesia [S07-CT-17, p.314]

09.45 - 10.00 **On stochastic logistic equation driven by fractional Brownian motion**
Herry Pribawanto Suryawan*, Boby Gunarso
Sanata Dharma University, Indonesia [S07-CT-18, p.315]

July 28 (Thu.) **Room: Mengwi 7**

12.00 - 12.30 Chair: Komang Dharmawan

12.00 - 12.15 **Pricing multi-asset equity options driven by a multidimensional variance gamma process under nonlinear dependence structures**
Komang Dharmawan
Udayana University, Indonesia [S07-CT-19, p.315]

12.15 - 12.30	**The application of cat swarm optimization algorithm in classifying small loan performance** Eka N. Kencana*, Nyoman Kiswanti, Kartika Sari Udayana University, Indonesia [S07-CT-20, p.316]

July 28 (Thu.)	**Room: Mengwi 7**
16.30 - 17.30	Chair: Heri Kuswanto
16.30 - 16.45	**Classification of inhibitor with enhanced inhibitor database using logistic regression ensemble approach** Heri Kuswanto*[1], Jainap Niken[1], Yogi Sarumaha[1], Hayato Ohwada[2] [1]Institut Teknologi Sepuluh Nopember, Indonesia [2]Tokyo University of Science Japan, Japan [S07-CT-21, p.317]
16.45 - 17.00	**Almost Marginal Conditional Stochastic Dominance (AMCSD) and its application in forming efficient portofolios** Isnandar Slamet*, Siska Mardiana Putri Carissa, Hasih Pratiwi Sebelas Maret University, Indonesia [S07-CT-22, p.317]
17.00 - 17.15	**Stick-breaking prior on Bayesian mixture-based general general neural network** Achmad S. Choir*[1], Brodjol S. S. Ulama[1], Nur Iriawan[1], Mohammad Dokhi[2] [1]Institut Teknologi Sepuluh Nopember (ITS), Indonesia [2]Institute of Statistics (STIS), Jakarta, Indonesia [S07-CT-23, p.318]
17.15 - 17.30	**Hierarchical time series buttom-up approach for forecast export value in Central Java** Dani Al Mahkya, Brodjol Sutijo Suprih Ulama, Suhartono Sepuluh Nopember Institute of Technology, Indonesia [S07-CT-24, p.318]

July 28 (Thu.)	**Room: Legian 1**
16.30 - 17.30	Chair: I Gede Nyoman Mindra Jaya
16.30 - 16.45	**Tripartite graph analysis on network of active compound-target protein-disease in elucidation of jamu working mechanism** Muchlishah Rosyadah*, Farit Mochamad Afendi, Wisnu Ananta Kusuma Bogor Agricultural University, Indonesia [S07-CT-25, p.319]
16.45 - 17.00	**The comparison of econometric models to estimate spillover effect by means of Monte Carlo simulation** I Gede Nyoman Mindra Jaya*[1], Henk Folmer[2,3], Budi Nurani Ruchjana[1] [1]Padjadjaran University, [2]University of Groningen, The Netherlands [3]Northwest Agriculture and Forestry University, China [S07-CT-26, p.320]
17.00 - 17.15	**Using partitioned design matrices in analyzing nested-factorial experiments** Sigit Nugroho University of Bengkulu, Indonesia [S07-CT-27, p.320]

17.15 - 17.30 **The application of conjoint analysis by thurstone procedure on Sekolah Tinggi Ilmu Statistik students preference of the lecture quality**
Fitri Catur Lestari
Sekolah Tinggi Ilmu Statistik, Indonesia [S07-CT-28, p.321]

July 29 (Fri.) **Room: Mengwi 7**

08.30 - 10.00 Chair: Leopoldus Ricky Sasongko

08.30 - 08.45 **Relative risk estimation of dengue disease in Bandung, Indonesia using poisson-gamma and BYM models considering the level of the severity**
Farah Kristiani, Benny Yong*
Parahyangan Catholic University, Indonesia [S07-CT-29, p.322]

08.45 - 09.00 **The comparison of three methods conjoint analysis based on respondent time to determine the choice of stimuli cards**
Fitri Catur Lestari
Sekolah Tinggi Ilmu Statistik, Indonesia [S07-CT-30, p.322]

09.00 - 09.15 **Spatial pattern analysis and spatial autocorrelation in economics growth in East Java**
Noviyanti Santoso[1], Sutikno[2]
Institut Teknologi Sepuluh Nopember, Indonesia [S07-CT-31, p.323]

09.15 - 09.30 **Multivariate rainfall disagregation with Bayesian mixture of multi-output neural networks**
Kartika Fithriasari*, Nur Iriawan, Brodjol S. S. Ulama
Institut Teknologi Sepuluh Nopember, Indonesia [S07-CT-32, p.323]

09.30 - 09.45 **Intangible heritage for sustainable future: mathematics in the coastal area**
Stanley Dewanto, Dianne Amor, Budi N. Ruchjana, Atje S. Abdullah
Universitas Padjadjaran [S07-CT-33, p.324]

09.45 - 10.00 **The method of mean value theorem for integrals to approximate renewal integral equations**
Leopoldus Ricky Sasongko*, Tundjung Mahatma
Satya Wacana Christian University, Indonesia [S07-CT-34, p.324]

July 29 (Fri.) **Room: Legian 3**

08.30 - 10.00 Chair: Dedi Rosadi

08.30 - 08.45 **Analytic approximations for American partial barrier options**
Doobae Jun*[1], Hyejin Ku[2]
[1]Gyeongsang National University, Korea
[2]York University, Canada [S07-CT-35, p.325]

08.45 - 09.00 **The impact of censored survival data on Bayesian analysis when fitting a mixture of Weibull models**
Sri Astuti Thamrin*[1], James McGree[2], Nicole White[2], Kerrie Mengersen[2]
[1]Hasanuddin University, Indonesia
[2]Queensland University of Technology, Australia [S07-CT-36, p.325]

09.00 - 09.15 **Modeling the fair market price of Sukuk Ijarah in Indonesia**
Dedi Rosadi*[1], Heni Wahyuni[1], Sri Redjeki[2]
[1]Gadjah Mada University, Indonesia
[2]STMIK AKAKOM, Indonesia [S07-CT-37, p.326]

09.15 - 09.30 **Mean-variance portfolio optimization by using non constant mean and volatility base-on risk tolerance**
Endang Soeryana Hasbullah*[1], Nurfadhlina bt Abdul Halim[2], Sukono[1]
Endang Rusyaman[1], Sudradjat Supian[1]
[1]Universitas Padjadjaran, Indonesia
[2]Universiti Malaysia Terengganu, Malaysia [S07-CT-38, p.326]

09.30 - 09.45 **Valuation of reload call option with binomial tree**
Yunita Wulan Sari*, Gunardi
Universitas Gadjah Mada, Indonesia [S07-CT-39, p.327]

09.45 - 10.00 **Estimation of heteroscedasticity semiparametric regression curve using fourier series approach**
Rahmawati Pane, Sutarman, Agus Salim Harahap
University of Sumatera Utara, Indonesia [S07-CT-40, p.327]

July 29 (Fri.) **Room: Mengwi 7**

13.30 - 14.45 Chair: Dadan Kusnandar

13.30 - 13.45 **Estimator truncated spline nonparametric regression in the geographically weighted regression model**
Sifriyani*[1], Haryatmi[1], Budiantara[2], Gunardi[1]
[1]Gadjah Mada University, Indonesia
[2]Institut Teknologi Sepuluh Nopember, Indonesia [S07-CT-41, p.328]

13.45 - 14.00 **Detection of distribution of hotspots in West Kalimantan using the ordinary kriging method**
Dadan Kusnandar*, Naomi Nessyana Debataraja
Tanjungpura University, Indonesia [S07-CT-42, p.328]

14.00 - 14.15 **Parameter estimation and hypothesis testing on geographically weighted gamma regression model**
Dina Eka Putri*, Purhadi, Dedy Dwi Prastyo
Institut Teknologi Sepuluh Nopember, Indonesia [S07-CT-43, p.329]

14.15 - 14.30 **Tourism prediction using Box-Jenkins ARIMA model**
Roxanne Daphne O. Lapaan*, Rizavel C. Addawe
Matthew Angelo M. Eugenio, Aujen Eymard K. Briones
University of the Philippines Baguio, Philippines [S07-CT-44, p.329]

14.30 - 14.45 **Forecasting Philippine daily stock exchange index**
Jackie D. Urrutia[1], John Lean B. Diaz[2], Edcon B. Baccay[2]
[1]Univ. of the Philippines - Sta. Mesa Campus
[2]Univ. of the Philippines-Para naque Campus [S07-CT-45, p.330]

July 29 (Fri.) **Room: Mengwi 3**

13.30 - 14.45 Chair: Fadhilah Yusof

13.30 - 13.45 **Strict solutions to stochastic linear evolution equations in Banach spaces**
Việt Tôn TẠ*[1], Yoshitaka Yamamoto[2], Atsushi Yagi[2]
[1]Kyushu University, Japan, [2]Osaka University, Japan [S07-CT-46, p.331]

13.45 - 14.00 **Rainfall prediction of Cimanuk watersheds regions with canonical correlation analysis**
S. Rustiana*[1], S. B. Sipayung[2], B. N. Ruchjana[3], A. S. Abdullah[3]
I Gede N. M. Jaya[3], Krismianto[2], Eddy Hermawan[2]
[1]IPB, Indonesia, [2]LAPAN Bandung, Indonesia
[3]Universitas Padjadjaran, Indonesia [S07-CT-47, p.331]

14.00 - 14.15 **Bivariate copula in drought modeling**
Fadhilah Yusof*, Foo Hui-Mean, Zulkifli Yusop, Jamaludin Suhaila
Universiti Teknologi Malaysia [S07-CT-48, p.332]

14.15 - 14.30 **Lattice path approach of M/G/1 queues with vacation**
Isnandar Slamet*[1], Ritu Gupta[2]
Narasimaha R. Achuthan[2], Roger Collinson[2]
[1]Sebelas Maret University, Indonesia
[2]Curtin University, Australia [S07-CT-49, p.333]

14.30 - 14.45 **Continuous time Markov chain in modeling the spread of influenza disease**
F. Novkaniza*, D. Aldila, M. Malik
Universitas Indonesia [S07-CT-50, p.333]

Poster Session

July 26 (Tue.) **Room: Pecatu Hall 3 and 5**

15.00 - 16.00

15.00 - 16.00 **To pool or not to pool: a test for the poolability of panel data**
Choji, Niri Martha*[1], DR.Sek Siok Kun[2], Datong, Godwin Monday[3]
[1]Plateau State University, Bokkos, Nigeria
[2]Universiti Sains Malaysia, [3]University of Jos, Nigeria [S07-P-01, p.334]

15.00 - 16.00 **New method for estimating the subset polynomial regression model by using reversible jump Markov chain Monte Carlo**
Suparman
Ahmad Dahlan University, Indonesia [S07-P-02, p.334]

15.00 - 16.00 **The effect of correlation between responses in bi-response nonparametric regression using smoothing spline**
Adji Achmad Rinaldo Fernandes
Universitas Brawijaya, Malang [S07-P-03, p.335]

15.00 - 16.00 **Universal portfolios generated by f-divergences**
Choon Peng Tan, Kee Seng Kuang
Universiti Tunku Abdul Rahman, Malaysia [S07-P-04, p.336]

15.00 - 16.00 **Parameter estimation of quadratics almost demand system of animal protein in Indonesia using generalized method of moments**
Fitria Virgantari[1], Hagni Wijayanti[1], Sonny Koeshendrajana[2]
[1]Pakuan University, Indonesia
[2]Ministry of Marine Affairs and Fisheries, Indonesia [S07-P-05, p.336]

15.00 - 16.00 **Zero inflated binomial models for neonatal infant mortality in Indonesia**
Wahyu Bodromurti*, Khairil Anwar Notodiputro
Bogor Agricultural University [S07-P-06, p.337]

15.00 - 16.00 **Soft set with constraints in decision making problem**
Fatia Fatimah[1], Dedi Rosadi*[1], RB. Fajriya Hakim[2]
[1]Universitas Gadjah Mada, [2]Universitas Islam Indonesia [S07-P-07, p.337]

15.00 - 16.00 **Forecasting of wind speed in Yogyakarta using radial basis function network based state dependent autoregressive**
Herni Utami
Universitas Gadjah Mada [S07-P-08, p.338]

15.00 - 16.00 **Analysis of variables affecting unemployment rate and detecting for cluster in Java island in 2015 to 2018**
Yekti Widyaningsih A, Didi Harlianto B, Putra A. Samuel C
Universitas Indonesia [S07-P-09, p.338]

15.00 - 16.00 **Modified HAM for solving a class of nonlinear Volterra-Fredholm Integro-difierential equations**
M. Kammuji[1], Z.K. Eshkuvatov[1,2], Arif A. M. Yunus[1]
[1]Universiti Sains Islam Malaysia (USIM), Malaysia
[2]Universiti Putra Malaysia (UPM) [S07-P-10, p.339]

15.00 - 16.00 **A statistical analysis on estimating the exchange rate of the Philippines**
Jackie D. Urrutia[1], Razzcelle L. Tampis[2]
[1]University of the Philippines - Sta. Mesa Campus
[2]University of the Philippines-Parañaque Campus [S07-P-11, p.339]

15.00 - 16.00 **Forecasting on the number of elderly people using ARIMA method**
Hery T. Sutanto
Universitas Negeri Surabaya, Indonesia [S07-P-12, p.340]

July 27 (Wed.)	**Room: Pecatu Hall 3 and 5**
08.30 - 10.00	
08.30 - 10.00	**Pricing of unit-linked life insurance contract with an asset value guarantee under the variance gamma process** Ferry Jaya Permana*, Dharma Lesmono, Erwinna Chendra Universitas Katolik Parahyangan, Indonesia [S07-P-13, p.340]
08.30 - 10.00	**Application of spatial scan statistic hotspot detection and ordit ranking on crimes committed by children in a district in Indonesia** Taruga Runadi, Yekti Widyaningsih Universitas Indonesia [S07-P-14, p.341]
08.30 - 10.00	**Scan statistic hotspot detection and ordit ordering based on health multivariable data in Depok** Choirul Basir*, Yekti Widyaningsih Universitas Indonesia [S07-P-15, p.342]
08.30 - 10.00	**Elucidation of jamu working mechanism based on network of active compound-target protein-gene ontology** Vitri Aprilla H*, Farit Mochamad Afendi, Wisnu Ananta Kusuma Bogor Agricultural University [S07-P-16, p.342]
08.30 - 10.00	**Generalized space time autoregressive with Exogeneous variable model and its application** Dewi Astuti[1], Soemartini[2], Budi Nurani Ruchjana*[2] [1]Bureau of West Sumatera, [2]Universitas Padjajaran [S07-P-17, p.343]
08.30 - 10.00	**The economic impact of priority economic sector in Central Java Province: an analysis of social accounting matrix** Sri Subanti[1], Inaki Maulida Hakim[2], Arif Rahman Hakim*[1,2] [1]Sebelas Maret University (UNS) [2]University of Indonesia [S07-P-18, p.343]
08.30 - 10.00	**Sis epidemic stochastic model for preventing influenza spread with intervention of medical mask and treatment** B. D. Handari*, M. Rohmah, D. Aldila Universitas Indonesia [S07-P-19, p.344]
08.30 - 10.00	**Jamu informatics: a new perspective in jamu research** Farit Mochamad Afendi*[1], Rudi Heryanto[1] Latifah Kosim Darusman[1], Nur Hilal A. Syahrir[1] Rizal Bakri[1], Nurul Qomariasih[1], Shigehiko Kanaya[2] [1]Bogor Agricultural University, Indonesia [2]Lab of Computational Systems Biology NAIST [S07-P-20, p.344]
08.30 - 10.00	**The application of conjoint analysis with fullprofile design and rating response on Sekolah Tinggi Ilmu Statistik student preference of the lecture quality** Fitri Catur Lestari Sekolah Tinggi Ilmu Statistik, Indonesia [S07-P-21, p.345]

08.30 - 10.00	**Analysis of hazard rate for proffering claim data in non-life insurance company with Weibull model** Septiani Muchtar*, Nurtiti Sanusi, Andi Kresna Jaya Hasanuddin University, Indonesia	[S07-P-22, p.346]
08.30 - 10.00	**Theory and application of kubinger test as the equivalent of two-way anova (case study: the effect of reparation method factor and brand factor to the lead level of Chinese medicinal herbs)** Fitri Catur Lestari Sekolah Tinggi Ilmu Statistik, Indonesia	[S07-P-23, p.346]

July 27 (Wed.) **Room: Pecatu Hall 3 and 5**

15.00 - 16.00

15.00 - 16.00	**Spatio temporal model: development and application** Budi Nurani Ruchjana*[1], Stanley P. Dewanto[1], Diah Chaerani[1] Atje Setiawan Abdullah[1], Juli Rejito[1] I Gede Nyoman Mindra Jaya[1], Eddy Hermawan[2] [1]Universitas Padjadjaran-Indonesia [2]Nat. Inst.of Aero.& Space Bandung-Indonesia	[S07-P-24, p.347]
15.00 - 16.00	**Application of Cox regression model in analyzing factors that affecting survival rate of tuberculosis patient (case study: Paru Hospital Bogor)** Embay Rohaeti, Ani Andriyati*, Prasetyorini, Esti Oktaviano Pakuan University, Indonesia	[S07-P-25, p.348]
15.00 - 16.00	**Classification of customer lifetime value model using Markov chain** Dony Permana*[1], Udjianna S. Pasaribu[2], Sapto W. Indratno[2], Suprayogi[2] [1]Padang State University, Indonesia [2]Institut Teknologi Bandung, Indonesia	[S07-P-26, p.348]
15.00 - 16.00	**Stochastic volatility models on Indonesian Rupiah exchange rate returns** Didit B. Nugroho*[1], Tundjung Mahatma*[1], Yulius Pratomo[2] Satya Wacana Christian University	[S07-P-27, p.349]
15.00 - 16.00	**Solving credibility using thin plate finite element splines** Windiani Erliana, Agah D. Garnadi, Sri Nurdiati, Gusti Putu Purnaba Bogor Agricultural University	[S07-P-28, p.350]
15.00 - 16.00	**Multivariate semiparametric regression** Sri Haryatmi Kartiko[1], Kartiko[2] [1]Universitas Gadjah Mada, Indonesia [2]Universitas Sebelas Maret, Indonesia	[S07-P-29, p.350]

15.00 - 16.00	**Application of poisson-gamma and standardized morbidity ratio (SMR) model in estimating relative risk of vehicle insurance claims**	
	Linda Cyrilla, Farah Kristiani	
	Parahyangan Catholic University, Indonesia	[S07-P-30, p.351]
15.00 - 16.00	**An application of GSTAR (1,1) model on oil palm data in PT. Perkebunan Nusantara XIII**	
	Dadan Kusnandar, Naomi N. Debataraja	
	Tanjungpura University, Indonesia	[S07-P-31, p.351]
15.00 - 16.00	**Simultaneous co-clustering and classification for marketing datasets**	
	Meta Anggistia*, Asep Saefuddin, Bagus Sartono	
	Bogor Agricultural University	[S07-P-32, p.352]
15.00 - 16.00	**Application of geostatistics on upperstream Citarum watershed, Indonesia**	
	Windy Setia Ningrum*, Yekti Widyaningsih, Tito Latif Indra	
	Universitas Indonesia	[S07-P-33, p.352]
15.00 - 16.00	**Space time scan statistic hotspot detection on maternal and infant death in Depok, 2007-2014**	
	Dita Irmayani Siregar*, Yekti Widyaningsih	
	University of Indonesia	[S07-P-34, p.353]
15.00 - 16.00	**Hotspot detection of malnutrition and pneumonia diseases cases in Depok district using spacetime scan statistic**	
	Miranti Verdiana*, Yekti Widyaningsih	
	Universitas Indonesia	[S07-P-35, p.353]
15.00 - 16.00	**Inflation data clustering of some cities in eastern Indonesia**	
	Adi Setiawan*, Bambang Susanto	
	Satya Wacana Christian University, Indonesia	[S07-P-36, p.354]

July 28 Thu	**Room: Pecatu Hall 3 and 5**	
08.30 - 10.00		
08.30 - 10.00	**The approximation of two-dimensional renewal integral equations using mean value theorem for integrals method**	
	Leopoldus R. Sasongko[1], Bambang Susanto*[1], Sapto W. Indratno[2]	
	[1]Satya Wacana Christian University	
	[2]Bandung Institute of Technology	[S07-P-37, p.354]
08.30 - 10.00	**Estimation of truncated spline in nonlinear SEM using weighted least squares method**	
	Ruliana*[1], I Nyoman Budiantara[2], Bambang W. Otok[2], Wahyu Wibowo[2]	
	[1]Makassar State University (UNM), Indonesia	
	[2]Institut Teknologi Sepuluh Nopember	[S07-P-38, p.355]

08.30 - 10.00 **British put option on stocks under stochastic interest rate**
Felipe R. Sumalpong, Jr.*[1], Elvira P. de Lara-Tuprio[2]
[1]MSU - Iligan Institute of Technology
[2]Ateneo de Manila University [S07-P-39, p.355]

08.30 - 10.00 **Stochastic claims reserving: the tweedie's compound Poisson model**
Lienda Noviyanti*, Achmad Zanbar Soleh, Gatot R. Setyanto
Universitas Padjadjaran [S07-P-40, p.356]

08.30 - 10.00 **Heterogeneity of parameters oil well using Gini index**
Atje Setiawan Abdullah, Anna Chadidjah*, Enny Supartini,
Emah Suryamah, Iin Irianingsih, Kankan Parmikanti,
Khafsah Joebaedi, Budi Nurani Ruchjana
Universitas Padjadjaran, Indonesia [S07-P-41, p.356]

08.30 - 10.00 **Fitting semivariogram model using linear optimization with R software**
Diah Chaerani*, Kankan Parmikanti
Budi Nurani Ruchjana, Atje Setiawan Abdullah
Universitas Padjadjaran, Indonesia [S07-P-42, p.357]

08.30 - 10.00 **Structural model to evaluate the effect of participation and satisfaction on ecotourism sustainability**
Eka N. Kencana*, Tresiani Manutami
Udayana University, Bali, Indonesia [S07-P-43, p.357]

08.30 - 10.00 **Bootstrap resampling to detect active zone for extreme rainfall in Indonesia**
Heri Kuswanto*, Sri Hidayati, Mutiah Salamah, Brodjol S. Ulama
Institut Teknologi Sepuluh Nopember, Indonesia [S07-P-44, p.358]

08.30 - 10.00 **Calculation of benefit reserves based on true m-thly benefit premiums**
Riaman*, Agus Supriatna, Dwi Susanti, Budi Nurani Ruchjana
Universitas Padjadjaran, Indonesia [S07-P-45, p.358]

08.30 - 10.00 **Forecasting using Hybrid Integer-valued Autoregressive Integrated Moving Average (INARIMA) and Radial Basis Function Neural Network (RBFNN)**
Fajarani Juliaristi*, Brodjol S. S. Ulama, Kartika Fithriasari
Sepuluh Nopember Institute of Technology [S07-P-46, p.359]

08.30 - 10.00 **Testing the predictability of event criticality based on restlessness precedence**
Yuyun Hidayat*[1], Titi Purwandari[1], Ismail Bin Mohd[2]
[1]Universitas Padjadjaran, Indonesia
[2]Universiti Malaysia Perlis, Malaysia [S07-P-47, p.359]

08.30 - 10.00 **Automatic adjustment mechanisms on private pension fund**
Joko Purwadi
Ahmad Dahlan University, Indonesia [S07-P-48, p.360]

July 28 (Thu.)	**Room: Pecatu Hall 3 and 5**
16.00 - 17.30	
16.00 - 17.30	**Comparative analysis of performance measures of redundant systems under Weibull failure and repair laws** Ashish Barak Manipal University Jaipur, India [S07-P-49, p.360]
16.00 - 17.30	**New ratio estimators for the finite population mean under SRS and RSS** Monika Saini Manipal University Jaipur. India [S07-P-50, p.361]
16.00 - 17.30	**Exploring the streamflow hydrograph using functional data** Shariffah Suhaila Syed Jamaludin Universiti Teknologi Malaysia [S07-P-51, p.361]
16.00 - 17.30	**Simulation studies non-trend series fourier estimator on additive multivariable nonparametric regression** I Wayan Sudiarsa*, I Nyoman Budiantara, Suhartono, Santi Wulan Purnami Institut Teknologi Sepuluh Nopember [S07-P-52, p.362]
16.00 - 17.30	**Spatial extreme value using bayesian hierarchical model for precipitation return levels prediction** Indria Tsani Hazhiah, Sutikno, Dedy Dwi Prastyo Institut Teknologi Sepuluh Nopember [S07-P-53, p.362]
16.00 - 17.30	**Local times for multifractional brownian motion in higher dimensions: a white noise approach** W. Bock[1], J. L. da Silva[2], H. P. Suryawan[3] [1]University of Kaiserslautern, Germany [2]University of Madeira, Portugal [3]Sanata Dharma University, Indonesia [S07-P-54, p.363]
16.00 - 17.30	**Optimum test for constant spatial regression using the Cameron-Martin density** Wayan Somayasa, Gusti N. Adhi Wibawa Halu Oleo University [S07-P-55, p.363]
16.00 - 17.30	**Early detection model of banking crisis in Indonesia based on Bank Deposits Indicator** Sugiyanto*, Etik Zukhronah, Ihsan Fathoni Amri Sebelas Maret University [S07-P-56, p.364]
16.00 - 17.30	**Bayesian mixture modeling for blood sugar levels of diabetes mellitus patients (case study in RSUD Saiful Anwar Malang Indonesia)** Ani Budi Astuti[1], Nur Iriawan[2], Laksmi Sasiarini[1] [1]University of Brawijaya Malang [2]Institut Teknologi Sepuluh Nopember, Surabaya [S07-P-57, p.365]

16.00 - 17.30 **Randomness of interest rates in microcredit**
Jasmin-Mae B. Santos[1], Marc Diener[2]
[1]University of the Philippines, Diliman
[2]Université de Nice, Sophia Antipolis [S07-P-58, p.365]

16.00 - 17.30 **Learning Poisson distribution through experiencing real life activities: interarrival times data collection**
Baiq Rika Ayu Febrilia*, Indira Puteri Kinasih
IKIP Mataram, Indonesia [S07-P-59, p.366]

16.00 - 17.30 **K-means and GIS for mapping natural disaster prone areas in Sumatera and Kalimantan islands**
Suwardi Annas*, Zulkifli Rais
Makassar State University, Makassar, Indonesia [S07-P-60, p.366]

16.00 - 17.30 **Statistical ARIMA model: development and application in LAPAN**
Eddy Hermawan*[1], Budi N. Ruchjana[2], Atje S. Abdullah[2],
I Gede N. M. Jaya[2], Sinta B. Sipayung[1], Shailla Rustiana[3], Krismianto[1]
[1]LAPAN Bandung, Indonesia, [2]Universitas Padjadjaran
[3]Institut Pertanian Bogor, Indonesia [S07-P-61, p.367]

July 29 (Fri.) **Room: Pecatu Hall 3 and 5**

08.30 - 10.00

08.30 - 10.00 **VARX and neural network models for forecasting train passenger data with calendar variation effect**
Lusi Indah Safitri, Suhartono, Dedy Dwi Prastyo
Institut Teknologi Sepuluh Nopember [S07-P-62, p.368]

08.30 - 10.00 **Regional income inequality measurement based on theil index decompotition and weighted variance coeficient**
Open Darnius
Universitas Sumatera Utara [S07-P-63, p.368]

08.30 - 10.00 **Hierarchical forecasting of currency inflow and outflow in Bank Indonesia based on hybrid ARIMAX-ANN with GARCH**
I Gede Surya Adi Prayoga, Suhartono, Santi Puteri Rahayu
Institut Teknologi Sepuluh Nopember [S07-P-64, p.369]

08.30 - 10.00 **The ranking of criteria for ship berthing at port dock using fuzzy TOPSIS in different number of experts**
Amirah Yaafar, Syibrah Naim, Lazim Abdullah, Ahmad Ayob
[1]Universiti Malaysia Terengganu [S07-P-65, p.370]

08.30 - 10.00 **The growth curves of Indonesia's education quality using p-splines quantile regression**
Yudhie Andriyana, Yadi Supriyadi, Toni Toharudin
Universitas Padjadjaran [S07-P-66, p.370]

July 29 (Fri.)	**Room: Pecatu Hall 3 and 5**
08.30 - 10.00	
08.30 - 10.00	**Multilevel structural equation modeling: analysis of weighted least square method on non-normal observed variables** Yudhie Andriyana, Yadi Supriyadi, Toni Toharudin Universitas Padjadjaran [S07-P-67, p.371]
08.30 - 10.00	**Selection of basic model for Black-Litterman portfolio** Retno Subekti, Sara Khairunnisa Yogyakarta State University [S07-P-68, p.371]
08.30 - 10.00	**Using lattice methods to solve real-options valuation problems with learning options and changing volatility** F. Werry, K.A. Sidarto Institut Teknologi Bandung, Indonesia [S07-P-69, p.372]
08.30 - 10.00	**Evaluating fuzzy and parametric model for portfolio selection using performance index** Kusumawati, Retno Subekti Yogyakarta State University [S07-P-70, p.372]
08.30 - 10.00	**Forecasting stochastic mortality rate and its accuracy** Yusuf H. Kalla, Khreshna I.A. Syuhada Institut Teknologi Bandung [S07-P-71, p.373]
08.30 - 10.00	**Comparison in feature selection techniques based on wrappers and embedded support vector machines for microarray data analysis** Shofi Andari, Santi Purnami Institut Teknologi Sepuluh Nopember Surabaya [S07-P-72, p.373]
08.30 - 10.00	**Production process quality control of steel pipe coating thickness using u-fuzzy control chart** Diaz Fitra Aksioma, Haryono Institut Teknologi Sepuluh Nopember Surabaya [S07-P-73, p.374]

S08. Combinatorics and Graph Theory

Invited Talks

July 26 (Tue.) — **Room: Mengwi 8**

Chair: Neil M. Mame

15.00 - 15.30 **Parity of latin squares**
Ian Wanless
Monash University, Australia [S08-IT-01, p.375]

July 27 (Wed.) — **Room: Mengwi 8**

Chair: Hasmawati

08.30 - 09.00 **Chromatic polynomials of hypergraphs: a survey**
Fengming Dong*, Ruixue Zhang
Nanyang Technological University, Singapore [S08-IT-02, p.376]

July 27 (Wed.) — **Room: Mengwi 8**

Chair: Jose Maria P. Balmaceda

15.00 - 15.30 **Resolvability of vertices in graphs**
Hilda Assiyatun
Institut Teknologi Bandung [S08-IT-03, p.376]

July 28 (Thu.) — **Room: Mengwi 8**

Chair: Shariefuddin Pirzada

08.30 - 09.00 **Euler characteristics in enumerative combinatorics**
Masahiko Yoshinaga
Hokkaido University, Japan [S08-IT-04, p.377]

July 28 (Thu.) — **Room: Mengwi 5**

Chair: Rinovia Simanjuntak

08.30 - 09.00 **Extension of splitting operation from graphs to binary matroids**
M. M. Shikare
Savitribai Phule Pune University, Pune (India) [S08-IT-05, p.377]

July 28 (Thu.)	**Room: Mengwi 8**
	Chair: Roslan Hasni
16.00 - 16.30	**TBA** Manoj Changat University of Kerala [S08-IT-06, p.378]

July 28 (Thu.)	**Room: Mengwi 6**
	Chair: Zu Yao Teoh
16.00 - 16.30	**A relation between the Tutte polynomial and the HOMFLY polynomial with applications in DNA polyhedra** Xian'an Jin Xiamen University, China [S08-IT-07, p.378]

July 28 (Thu.)	**Room: Pecatu Hall 1 and 2**
	Chair: L. Susilowati
16.00 - 16.30	**Hamilton-connectedness in the square of non-separable graphs** Gek Ling Chia[1,2] [1]Universiti Tunku Abdul Rahman, Malaysia [2]University of Malaya, Malaysia [S08-IT-08, p.379]

Contributed Talks

July 26 (Tue.)	**Room: Mengwi 8**
15.30 - 17.00	Chair: Neil M. Mame
15.30 - 15.45	**Generator subgraphs of wheel graphs** Neil M. Mame*[1], Severino V. Gervacio[2] [1]Batangas State University, Philippines [2]De La Salle University, Manila, Philippines [S08-CT-01, p.379]
15.45 - 16.00	**Hypercubes are determined by their distance spectra** Sakander Hayat*, Jack Koolen, Quaid Iqbal University of Science and Technology of China [S08-CT-02, p.380]
16.00 - 16.15	**A solution of the Erdös - Faber - Lovász conjecture** S. M. Hegde, Suresh Dara National Inst. of Technology Karnataka, India [S08-CT-03, p.380]
16.15 - 16.30	**On the computational complexity of Roman domination parameters in graph** Nader Jafari Rad Shahrood University of Technology, Iran [S08-CT-04, p.381]

15.45 - 16.00 **Rainbow 2-connectivity of some classes of Halin graphs approaches**
Bety Hayat Susanti[*1,2], A.N.M. Salman[1], Rinovia Simanjuntak[1]
[1]Institut Teknologi Bandung
[2]Sekolah Tinggi Sandi Negara, Indonesia [S08-CT-05, p.382]

16.45 - 17.00 **Dihedral Cayley graph: good drawing and domination number**
Maria Linda C. Cabillan, Ia Kristine P. Miranda, Shielden Grail S. Domilies
Bryan Ceasar L. Felipe[*], Niño Angelo L. Gaviño, Clarenz B. Magsakay[*]
Christine Mae R. Penullar, Jomark Francis A. Velasco
Saint Louis University, Philippines [S08-CT-06, p.382]

July 27 (Wed.) **Room: Mengwi 8**

09.00 - 10.00 Chair: Hasmawati

09.00 - 09.15 **The Ramsey number of a linear forest versus a wheel**
Surahmat Supangken[1*], Edy Tri Baskoro[2]
[1]Unisma, Malang, Indonesia
[2]Institut Teknologi Bandung, Indonesia [S08-CT-07, p.382]

09.15 - 09.30 **The Ramsey numbers for stars of odd order versus a wheel of order nine**
Hasmawati
Hasanuddin University of Makassar [S08-CT-08, p.383]

09.30 - 09.45 **On size multipartite Ramsey numbers for stars versus paths and cycles**
Anie Lusiani[*], Edy Tri Baskoro, Suhadi Wido Saputro
Institut Teknologi Bandung, Indonesia [S08-CT-09, p.383]

09.45 - 10.00 **Restricted size Ramsey number for P_3 versus graph of order at most five**
Denny Riama Silaban[*], Edy Tri Baskoro, Saladin Uttunggadewa
Institut Teknologi Bandung, Indonesia [S08-CT-10, p.384]

July 27 (Wed.) **Room: Mengwi 8**

15.30 - 16.00 Chair: Jose Maria P. Balmaceda

15.30 - 15.45 **The rainbow vertex connection number of the amalgamation of graphs**
Rosmaini[*], A.N.M. Salman
Institut Teknologi Bandung [S08-CT-11, p.384]

16.30 - 16.45 **Subgroups as dominating sets for a Cayley graph of the dicyclic group**
Jose Maria P. Balmaceda[*1], Joris N. Buloron[2], Carmelita M. Loquias[3]
[1]University of the Philippines Diliman, [2]Cebu Normal University
[3]University of San Carlos Cebu [S08-CT-12, p.385]

July 28 (Thu.) **Room: Mengwi 8**

09.00 - 09.45 Chair: Shariefuddin Pirzada

09.00 - 09.15 **On the sum of the Laplacian eigenvalues of a graph**
Shariefuddin Pirzada, Hilal Ahmed Ganai
University of Kashmir, India [S08-CT-13, p.385]

09.15 - 09.30 **Restrained-isolate domination in graphs**
Benjier H. Arriola
Basilan State College [S08-CT-14, p.386]

09.30 - 09.45 **Domination in compositions in graphs**
Sergio R. Canoy, Jr.*[1], Carmelito E. Go[2]
[1]MSU-Iligan Institute of Technology, Philippines
[2]Mindanao State University, Philippines [S08-CT-15, p.386]

July 28 (Thu.) **Room: Mengwi 5**

09.00 - 10.00 Chair: Rinovia Simanjuntak

09.00 - 09.15 **Log-concavity, unimodality and monotonicity of s-rook numbers**
Richell O. Celeste[1], Roberto B. Corcino[2], Ken Joffaniel M. Gonzales*[1]
[1]University of the Philippines, Diliman
[2]Cebu Normal University [S08-CT-16, p.387]

09.15 - 09.30 **Graph theory problems arising from angklung performance**
Brilly Maxel Salindeho*, Edy Tri Baskoro
Institut Teknologi Bandung, Indonesia [S08-CT-17, p.388]

09.30 - 09.45 **The rainbow 3-connection number of the cartesian product of a path and certain graphs**
M.A. Shulhany*, A.N.M. Salman
Institut Teknologi Bandung, Indonesia [S08-CT-18, p.388]

09.45 - 10.00 **Hypermatrices and hypergraphs**
Daniel Allan Juvito
Institut Teknologi Bandung, Indonesia [S08-CT-19, p.389]

July 28 (Thu.) **Room: Mengwi 8**

11.30 - 12.30 Chair: Hua Mao

11.30 - 11.45 **Results on the Roman domination vertex critical graphs**
Nader Jafari Rad
Shahrood University of Technology [S08-CT-20, p.389]

11.45 - 12.00 **Special factors and forbidden words of random Noble means words at most five**
Mark Camilo C. Mamaril, Eden Delight P. Miro
Ateneo de Manila University, Philippines [S08-CT-21, p.390]

12.00 - 12.15	**Some properties of matroids obtained from concept lattice approaches**	
	Hua Mao	
	Hebei University, China	[S08-CT-22, p.390]
12.15 - 12.30	**A-differential of graphs under some binary operations**	
	Cris L. Armada*, Sergio R. Canoy, Jr.	
	Mindanao State University, Philippines	[S08-CT-23, p.391]

July 28 (Thu.) **Room: Mengwi 8**

16.30 - 17.30 Chair: Roslan Hasni

16.30 - 16.45	**$(1,2)^*$-domination in graphs**	
	Sergio R. Canoy, Jr.*[1], Shaleema A. Ariola[2]	
	[1]MSU-Iligan Institute of Technology, Philippines	
	[2]Basilan State College, Philippines	[S08-CT-24, p.392]
16.45 - 17.00	**On locating-dominating sets of product graphs**	
	Suhadi Wido Saputro	
	Institut Teknologi Bandung, Indonesia	[S08-CT-25, p.392]
17.00 - 17.15	**On the locating chromatic number of cubic Halin graphs**	
	Ira Apni Purwasih*, Edy Tri Baskoro, Hilda Assiyatun, Djoko Suprijanto	
	Institut Teknologi bandung	[S08-CT-26, p.393]
17.15 - 17.30	**Some domination parameters in generalized Jahangir graph $J_{n,m}$**	
	Roslan Hasni*[1], Safa Mtarneh[1],, Doost Ali Mojdeh[2]	
	[1]Universiti Malaysia Terengganu, Malaysia	
	[2]Tafresh University, Tafresh, Iran	[S08-CT-27, p.393]

July 28 (Thu.) **Room: Mengwi 6**

16.30 - 17.30 Chair: Zu Yao Teoh

16.30 - 16.45	**Are Ramsey algebras essentially semigroups**	
	Zu Yao Teoh*, Wen Chean Teh	
	Universiti Sains Malaysia	[S08-CT-28, p.394]
16.45 - 17.00	**Subdivision of graphs in $\mathcal{R}(mK_2, P_4)$**	
	Kristiana Wijaya*, Edy Tri Baskoro, Hilda Assiyatun, Djoko Suprijanto	
	Institut Teknologi Bandung, Indonesia	[S08-CT-29, p.394]
17.00 - 17.15	**On $(3P_2, 2C_3)$ and $(2P_3, 2C_3)$-classes graphs Ramsey minimal**	
	I W. Sudarsana*, S. Musdalifah, Halimah, D. Winarsih	
	Tadulako University, Indonesia	[S08-CT-30, p.395]
17.15 - 17.30	**Some infinite families of Ramsey (P_3, P_n)-minimal graphs for small n**	
	Desi Rahmadani*[1], Edy Tri Baskoro[1], Martin Bača[2], Hilda Assiyatun[1]	
	Andrea Semaničová-Feňovčíková[2]	
	[1]ITB, [2]Technical University, Slovak Republic	[S08-CT-31, p.395]

July 28 (Thu.) **Room: Pecatu Hall 1 and 2**

16.30 - 17.30 Chair: L. Susilowati

16.30 - 16.45 **On locating-chromatic number for graphs with two homogenous components**
Des Welyyanti*, Edy Tri Baskoro, Rinovia Simanjuntak, Saladin Uttunggadewa
Institut Teknologi Bandung [S08-CT-32, p.396]

16.45 - 17.00 **Locating-chromatic number of the edge-amalgamation of trees**
Dian Kastika Syofyan*, Edy Tri Baskoro, Hilda Assiyatun
Institut Teknologi Bandung, Indonesia [S08-CT-33, p.397]

17.00 - 17.15 **On commutative characterization of graph operations with respect to local metric dimension**
L. Susilowati*[1], M.I. Utoyo[1], Slamin[2]
[1]Universitas Airlangga, Indonesia
[2]Universitas Jember, Indonesia [S08-CT-34, p.397]

17.15 - 17.30 **On the metric dimension of lollipop graph, Mongolian tent graph, and generalized Jahangir graph**
Ardina Rizqy Rachmasari*, Tri Atmojo Kusmayadi
Sebelas Maret University, Indonesia [S08-CT-35, p.398]

July 29 (Fri.) **Room: Mengwi 8**

08.30 - 10.00 Chair: A. A. G. Ngurah

08.30 - 08.45 **Characterization of completely k-magic regular graphs, $k \geq 3$**
Arnold A. Eniego*[1], I.J.L Garces[2]
[1]National University, Manila
[2]Ateneo de Manila University [S08-CT-36, p.398]

08.45 - 09.00 **C_4-supermagic labeling of the grid graph**
Rachel Wulan Nirmalasari Wijaya*, Thomas Kalinowski
The University of Newcastle, Australia [S08-CT-37, p.399]

09.00 - 09.15 **On the (super) edge-magic deficiency of graphs and cycles**
A. A. G. Ngurah*[1], R. Simanjuntak[2]
[1]Universitas Merdeka Malang, Indonesia
[2]Institut Teknologi Bandung, Indonesia [S08-CT-38, p.399]

09.15 - 09.30 **A generalized shackle of any graph H admits a super H-antimagic total labeling**
Dafik*, Moh. Hasan, Y. N. Azizah, I. H. Agustin
University of Jember, Indonesia [S08-CT-39, p.400]

09.30 - 09.45 **Proof of a conjecture on super edge-magic deficiency of graphs**
S. M. Hegde, Suresh Dara
National Institute of Technology Karnataka, India [S08-CT-40, p.400]

09.45 - 10.00 **On graph labeling and deficiency of antimagic types**
Tao-Ming Wang
Tunghai University, Taichung, Taiwan [S08-CT-41, p.401]

July 29 (Fri.)	**Room: Mengwi 6**
08.30 - 10.00	Chair: Muhammad Imran
08.30 - 08.45	**On metric graphic sets** Jose B. Rosario*, Ian June L. Garces Ateneo de Manila University [S08-CT-42, p.402]
08.45 - 09.00	**On the total resolving number of wheel-like graphs** Hikmatiarahmah Kekaleniate*, Edy Tri Baskoro Institut Teknologi Bandung, Indonesia [S08-CT-43, p.402]
09.00 - 09.15	**On the partition dimension of two-component graphs** Debi Oktia Haryeni*[1], Edy Tri Baskoro[1], Suhadi Wido Saputro[1] Martin Bača[2], Andrea Seminačová-Feňovčíková[2] [1]Institut Teknologi Bandung [2]Technical University in Košice, Slovakia [S08-CT-44, p.403]
09.15 - 09.30	**On the partition dimension of antiprism graph, Mongolian tent graph, and stacked book graph** Tia Apriliani*, Tri Atmojo Kusmayadi Sebelas Maret University, Indonesia [S08-CT-45, p.403]
09.30 - 09.45	**On the metric dimension of wheel related graphs** Muhammad Imran[1,2], Syed Ahtsham Ul Haq Bokhary[3], Zil-e-Shams[3] [1]National Univ. of Sci. & Tech., Pakistan [2]Univ. of the Free State, South Africa [3]Bahaudin Zakariya University, Pakistan [S08-CT-46, p.404]
09.45 - 10.00	**On the chain blockers of a poset** Sarfraz Ahmad COMSATS Institute of Information Technology, Lahore [S08-CT-47, p.405]

July 29 (Fri.)	**Room: Mengwi 8**
13.30 - 15.00	Chair: Meilin I. Tilukay
13.30 - 13.45	**Graceful labeling of dihedral Cayley graphs** Maria Linda C. Cabillan*, Victoriano I. Ferrer Jr, Noelyn Anne A. Daria, Jet Lee L. Tulas, Albert S. Turalba* Saint Louis University, Philippines [S08-CT-48, p.405]
13.45 - 14.00	**On the total irregularity strength of several types of trees** Meilin I. Tilukay*[1], A. N. M. Salman[2] [1]Universitas Pattimura, Indonesia [2]Institut Teknologi Bandung, Indonesia [S08-CT-49, p.406]
14.00 - 14.15	**Total vertex irregularity strength of trees with maximum degree five** Susilawati*, Edy Tri Baskoro, Rinovia Simanjuntak Institut Teknologi Bandung, Indonesia [S08-CT-50, p.406]
14.15 - 14.30	**The minimal size of rainbow 2-connected graphs** D. Resty*[1], A.N.M. Salman[2] Institut Teknologi Bandung, Indonesia [S08-CT-51, p.407]

14.30 - 14.45 **On the total disjoint irregularity strength of wheels and related graphs and cycles**
Meilin I. Tilukay*[1], A. N. M. Salman[2], F. Y. Rumlawang[1]
[1]Universitas Pattimura, Indonesia
[2]Institut Teknologi Bandung, Indonesia [S08-CT-52, p.407]

14.45 - 15.00 **Constructions of encryption key by using a super H-antimagic total graph**
A. C. Prihandoko*[1], Dafik[2], Slamin[1], A. I. Kristiana[2]
University of Jember, Indonesia [S08-CT-53, p.408]

July 29 (Fri.) **Room: Mengwi 6**

13.30 - 15.00 Chair: Dafik

13.30 - 13.45 **The r-dynamic chromatic number of several classes of graphs**
Dafik*[1], I.H. Agustin[2], D.E.W. Meganingtyas[2]
K.D. Purnomo[2], M.D. Tarmidzi[2], N.I. Wulandari[2]
University of Jember, Indonesia [S08-CT-54, p.409]

13.45 - 14.00 **Game chromatic number and game coloring number of Hanoi graph**
Emrah Akyar*, Ummahan Akcan, Handan Akyar
Anadolu University, Turkey [S08-CT-55, p.409]

14.00 - 14.15 **Scrambling index of a class of two-colored two cycles whose lengths differ by 2**
Mulyono[1], Saib Suwilo*[2], Hari Sumardi[2]
[1]State University of Medan, Indonesia
[2]University of Sumatera Utara, Indonesia [S08-CT-56, p.410]

14.15 - 14.30 **Perfect Matching with Restriction in Uncertain Network**
I. Rosyida*[1,2], Jin Peng[3], Lin Chen[3], Widodo[2],
Ch. Rini Indrati[2], Kiki A. Sugeng[4]
[1]Gadjah Mada University, Indonesia, [2]Semarang State University, Indonesia
[3]Huanggang Normal University, China
[4]University of Indonesia [S08-CT-57, p.410]

14.30 - 14.45 **L(2,1)-coloring and its related problems on join of certain graphs and cycles**
Srinivasa Rao Kola, Balakrishna Gudla
National Inst. of Technology Karnataka, India [S08-CT-58, p.411]

14.45 - 15.00 **Rainbow connection and strong rainbow connection for $C_n + \overline{K_r}$**
Srava Chrisdes Antoro*, Fendy Septyanto, Kiki Ariyanti Sugeng
Universitas Indonesia [S08-CT-59, p.412]

Poster Session

July 27 (Wed.)	Room: Pecatu Hall 3 and 5
08.30 - 10.00	
08.30 - 10.00	**The locating-chromatic number for certain amalgamation of stars** Asmiati Lampung University, Indonesia [S08-P-01, p.412]
08.30 - 10.00	**On the existence of cyclic simple BIBDs** Hsin-Min Sun National University of Tainan, Taiwan [S08-P-02, p.413]
08.30 - 10.00	**The connected size Ramsey number for matchings versus small stars or cycles** Budi Rahadjeng*, Edy Tri Baskoro, Hilda Assiyatun Institut Teknologi Bandung, Indonesia [S08-P-03, p.413]
08.30 - 10.00	**The Harary index of the nanotube** $TUC_4C_8[p, q]$ Sarfraz Ahmad, Fareeha Ambar* COMSATS Inst. of Information Tech., Lahore [S08-P-04, p.414]
08.30 - 10.00	**On the partition dimension of barbell graph, double cones graph, and** $K_1 + (P_1 \odot K_n)$ Tri Atmojo Kusmayadi, Sri Kuntari, Dwi Wahyu Hidayat Sebelas Maret University, Indonesia [S08-P-05, p.415]
08.30 - 10.00	**The partition dimension of a subdivision of homogeneous firecrackers** Amrullah[1], Edy Tri Baskoro[2], Saladin Uttunggadewa[2], Rinovia Simanjuntak[2] [1]Universitar Mataram, Indonesia [2]Institut Teknologi Bandung, Indonesia [S08-P-06, p.415]

July 27 (Wed.)	Room: Pecatu Hall 3 and 5
15.00 - 16.00	
15.00 - 16.00	**Shifted analogues of the tableau switching** Seung-Il Choi[1], Sun-Young Nam*[2], Young-Tak Oh[3] [1]Seoul National University, [2]Korea Institute for Advanced Study [3]Sogang University [S08-P-07, p.416]
15.00 - 16.00	**On metric dimension of edge-corona product of graphs** Rinurwati*[1,2], Herry Suprajitno[1], Slamin[3] [1]Airlangga University, Surabaya, Indonesia, [2]ITS Surabaya, Indonesia [3]Jember University, Indonesia [S08-P-08, p.416]

15.00 - 16.00	**On the sigma chromatic number of the join of a finite number of paths and cycles** Maria Czarina T. Lagura*, Agnes D. Garciano, Reginaldo M. Marcelo Ateneo de Manila University, Philippines [S08-P-09, p.417]
15.00 - 16.00	**Spectrum of minimum degrees on t-critically-edge-connected graphs** I Ketut Budayasa, Dwi Juniati Universitas Negeri Surabaya [S08-P-10, p.418]
15.00 - 16.00	**The rainbow connection number of certain generalized Jahangir graphs** S. Nabila*, A. N. M. Salman Institut Teknologi Bandung [S08-P-11, p.418]
15.00 - 16.00	**The rainbow vertex-connection number of star cycle graphs and star mobius ladder graphs** W.B. Ariestha*, A.N.M. Salman Institut Teknologi Bandung [S08-P-12, p.419]
15.00 - 16.00	**The rainbow vertex-connection number of some shield graphs** R. Palupi*, A.N.M. Salman Institut Teknologi Bandung [S08-P-13, p.419]

July 28 (Thu.) **Room: Pecatu Hall 3 and 5**

08.30 - 10.00

08.30 - 10.00	**Properties of antiadjacency eigenvalues of regular and line graphs** Kiki Ariyanti Sugeng Universitas Indonesia [S08-P-14, p.420]
08.30 - 10.00	**Eigenvalues of adjacency and Laplacian matrices of graph Spl$(G) - E(G)$ for some regular graph G** Wisnu Aribowo*, Kiki Ariyanti Sugeng Universitas Indonesia [S08-P-15, p.420]
08.30 - 10.00	**Closed geodetic numbers of graphs resulting from some graph operations** Imelda S. Aniversario*, Ferdinand P. Jamil Mindanao State Univ.-Iligan Inst. of Technology [S08-P-16, p.421]
08.30 - 10.00	**Eigenvalues of adjacency, antiadjacency, and Laplacian matrices of bracelet$-K_n$ graph** Ermita Rizki Albirri*, Kiki Ariyanti Sugeng Universitas Indonesia [S08-P-17, p.421]
08.30 - 10.00	**On the metric dimension of web graph, generalized flower graph and $C_n *_2 K_m$ graph** Dwi Ria Kartika*, Tri Atmojo Kusmayadi Sebelas Maret University, Indonesia [S08-P-18, p.422]

08.30 - 10.00	**The eccentric digraph of a graph**	
	Eka Ferawati*, Tri Atmojo Kusmayadi	
	Sebelas Maret University, Indonesia	[S08-P-19, p.423]
08.30 - 10.00	**Signed product cordial labeling of flower graph $f_{n\times 4}$ with graph operations is duplicating all the edges**	
	Siti Julaeha*, Hadiati	
	State Islamic University Bandung, Indonesia	[S08-P-20, p.423]
08.30 - 10.00	**Gray codes inducing complete bipartite graphs**	
	I Nengah Suparta	
	Universitas Pendidikan Ganesha, Bali, Indonesia	[S08-P-21, p.424]

July 28 (Thu.) **Room: Pecatu Hall 3 and 5**

16.00 - 17.30

16.00 - 17.30	**A note on skew-checkered weighing matrices and association schemes**	
	Wai-Keong Kok*, Li-Yin Tan	
	Tunku Abdul Rahman University College, Malaysia	[S08-P-22, p.424]
16.00 - 17.30	**On the rc and src of graphs containting joins with $\overline{K_n}$**	
	Fendy Septyanto*, Kiki Ariyanti Sugeng	
	Universitas Indonesia	[S08-P-23, p.425]
16.00 - 17.30	**The characteristic polynomials of the adjacency and anti-adjacency matrices of amalgamation of two complete graphs**	
	Diah Prastiwi*, Kiki Ariyanti Sugeng	
	Universitas Indonesia	[S08-P-24, p.425]
16.00 - 17.30	**The H-super(anti)magic decompositions of generalized toroidal prism and antiprism graphs**	
	Hendy*, Ahmad Dzulfikar	
	Universitas Pesantren Tinggi Darul 'Ulum, Indonesia	[S08-P-25, p.426]
16.00 - 17.30	**On some properties of a (p,q)-analogues type I and type II of the unified stirling numbers**	
	Omar I. Cauntongan	
	Mindanao State University	[S08-P-26, p.426]
16.00 - 17.30	**Totally irregular total labeling of some caterpillar graphs**	
	Diari Indriati*[1,2], Widodo[1], Indah E. Wijayanti[1], Kiki A. Sugeng[3]	
	[1]University of Gadjah Mada, Indonesia	
	[2]University of Sebelas Maret, Indonesia	
	[3]University of Indonesia, Indonesia	[S08-P-27, p.427]
16.00 - 17.30	**On the distance two-dominating number of graphs resulting from graph operations**	
	Wicha Dwi Vikade[1], K. D. Purnomo[1], Slamin*[2]	
	Universitas Jember, Indonesia	[S08-P-28, p.428]

July 29 (Fri.)	**Room: Pecatu Hall 3 and 5**
08.30 - 10.00	
08.30 - 10.00	**On the rainbow connection number of graphs and its operations** I. H. Agustin*, Dafik, M. S. Hasan, R. N. Darmawan, R. Hidayat University of Jember, Indonesia [S08-P-29, p.428]
08.30 - 10.00	**Construction of super edge antimagicnes of disjoint union of any graph by using a graph coloring technique** A. I. Kristiana*, M. Mahmudah, Dafik, K. D. Purnomo University of Jember, Indonesia [S08-P-30, p.429]
08.30 - 10.00	**Super complete-antimagicness of amalgamation of complete graph** I. H. Agustin*, Dafik, M. D. Milasari University of Jember, Indonesia [S08-P-31, p.429]
08.30 - 10.00	**Super total antimagic d-face labeling from corona results of friendship graph with path graph** Vicardy Kempa, Darmaji Sepuluh Nopember Institute of Technology [S08-P-32, p.430]
08.30 - 10.00	**Bi-resolving graph of cycle-related graphs** Hazrul Iswadi Universitas Surabaya, Indonesia [S08-P-33, p.430]
08.30 - 10.00	**Local metric dimension of circulant graph** Ruzika Rimadhany*, Darmaji Institut Teknologi Sepuluh Nopember, Indonesia [S08-P-34, p.431]
08.30 - 10.00	**Fuzzy autocatalytic set (FACS) and first isomorphism theorem** Rossiana Edhelyn*, Tahir Ahmad Universiti Teknologi Malaysia [S08-P-35, p.431]
08.30 - 10.00	**The partition dimension of comb product graphs** Novi Mardiana*[1], Suhadi Wido Saputro[2], Faisal[3] [1]Kopertis Wilayah IV Bandung, Indonesia [2]Institut Teknologi Bandung, Indonesia [3]Bina Nusantara University, Indonesia [S08-P-36, p.432]

S09. Mathematical Aspects of Computer Science, Numerical Analysis and Scientific Computing /Mathematics in Science and Technology

Invited Talks

July 26 (Tue.) **Room: Legian 1**

Chair: Carlene Pilar-Arceo

15.00 - 15.30 **On some variations of the Gärtner-Ellis theorem with applications to information theory**

Vincent Tan Yan Fu

National University of Singapore [S09-IT-01, p.433]

July 26 (Tue.) **Room: Legian 2**

Chair: Amita Bhagat

15.00 - 15.30 **Operator Splitting Methods For The Phase Field Equations**

Hyun Geun Lee, Jaemin Shin, June-Yub Lee*

Ewha Womans University, Seoul 120-750, Korea [S09-IT-02, p.433]

July 27 (Wed.) **Room: Legian 1**

Chair: A. K. Supriatna

08.30 - 09.00 **Optimal hitting set generator and application to pseudorandom generator**

Chaoping Xing

Nanyang Technological University [S09-IT-03, p.434]

July 27 (Wed.) **Room: Legian 2**

Chair: Thien Binh Nguyen

08.30 - 09.00 **Performance evaluation of some hybrid clustering approaches in analyzing an endemic virus family**

A. Bustamam*, H. Muradi

K.R. Adzima, S. Wulandari, G. Suryawati

Universitas Indonesia [S09-IT-04, p.434]

July 28 (Wed.)	**Room: Legian 1**
	Chair: Abdullah Shah
08.30 - 09.00	**A two-level additive Schwarz preconditioner for partition of unity methods** Susanne C. Brenner Louisiana State University, USA [S09-IT-05, p.435]

July 28 (Thu.)	**Room: Legian 2**
	Chair: Jerrold M. Tubay
16.00 - 16.30	**TBA** Zhou Jian Tsinghua University, China [S09-IT-06, p.435]

Contributed Talks

July 26 (Tue.)	**Room: Legian 1**
15.30 - 17.00	Chair: Carlene Pilar-Arceo
15.30 - 15.45	**A study of the diffusive Lotka Volterra system with holling type 2 functional response** Hanz Martin Cheng*, Roden Jason David* Ateneo de Manila University [S09-CT-01, p.436]
15.45 - 16.00	**Chemical reaction network approaches to biochemical systems theory** Carlene Perpetua P. Arceo[1], Editha C. Jose*[2], Angelyn P. Lao[3] Alberto Marin-Sanguino[4], Eduardo R. Mendoza[5] [1]University of the Philippines Diliman, Quezon City [2]University of the Philippines Los Baños [3]De la Salle University, Manila, Philippines [4]Technische Universität München [5]Ludwig Maximilian University [S09-CT-02, p.436]
16.00 - 16.15	**Magnetohydrodynamics of unsteady viscous fluid on boundary layer past a sliced sphere** Rahmat Nursalim*, Basuki Widodo, Choirul Imron Institut Teknologi Sepuluh Nopember [S09-CT-03, p.437]
16.15 - 16.30	**Modeling and simulation of ocean wave propagation using lattice Boltzmann method** Dian Nuraiman UIN Sunan Gunung Djati Bandung [S09-CT-04, p.438]

16.30 - 16.45 **Parameter estimation for S-system models using the bat algorithm**
Carlene Pilar-Arceo*[1], Jayson Lucilo[2], Eduardo Mendoza[3]
[1]University of the Philippines Diliman
[2]College of Science, Bicol University
[3]Ludwig Maximilians University [S09-CT-05, p.438]

16.45 - 17.00 **Optimal traffic light control under congestions: case study Universitas Gadjah Mada, Yogyakarta Indonesia**
Endrayanto, I.*[1], Nurwantoro, P.[2], Priyambodo, T.K.[3]
Universitas Gadjah Mada, Indonesia [S09-CT-06, p.439]

July 27 (Wed.) **Room: Legian 2**

15.00 - 16.00 Chair: Amita Bhagat

15.30 - 15.45 **Image processing based detection of lung cancer on CT scan images**
Bariqi Abdillah, Alhadi Bustamam, Devvi Sarwinda
Universitas Indonesia [S09-CT-07, p.439]

15.45 - 16.00 **Hybrid finite element modeling for wave induced oscillation in Pohang new Harbor**
Prashant Kumar[1], Kim Kwang Ik[2]
[1]National Inst. of Tech. Delhi, India
[2]Pohang University, South Korea [S09-CT-08, p.440]

16.00 - 16.15 **On the Drazin-inverse solution of the multilevel Krylov method**
Damira Alshimbayeva, Yogi Erlangga
Nazarbayev University, Kazakhstan [S09-CT-09, p.440]

16.15 - 16.30 **Mathematical epigenetic and phenotypic fitness landscapes: evolutionary effect of pathogens on host traits**
Jomar F. Rabajante[1*], Mark Jayson V. Cortez[1]
Jerrold M. Tubay[1], Juancho A. Collera[2]
Ariel L. Babierra[1], Editha C. Jose[1]
[1]University of the Philippines Los Baños
[2]University of the Philippines Baguio [S09-CT-10, p.441]

16.30 - 16.45 **A mathematical model of solid oxide fuel cell fed biomass derived fuel**
Sineenart Srimongkol
Burapha University [S09-CT-11, p.442]

16.45 - 17.00 **Retrial G-queue with preemptive resume, server breakdowns and two phase service**
Amita Bhagat
NCU University, India [S09-CT-12, p.442]

July 27 (Wed.)	**Room: Legian 1**
09.00 - 10.00	Chair: A. K. Supriatna
09.00 - 09.15	**A mathematical model of wolbachia infection to control dengue disease with human response behaviour** A. K. Supriatna*, N. Anggriani, Melanie Padjadjaran University, Indonesia [S09-CT-13, p.443]
09.15 - 09.30	**Influence of thermal radiation on heat and mass transfer of unsteady MHD free convection flow of Jeffrey fluid with newtonian heating** Nor Athirah Mohd Zin[1*], Ilyas Khan[2] Ahmad Qushairi Mohamad[1], Sharidan Shafie[1] [1]Universiti Teknologi Malaysia [2]College of Engineering Majmaah University [S09-CT-14, p.443]
09.30 - 09.45	**Unsteady MHD mixed convection flow of rotating second grade fluid with ramped wall temperature** Ahmad Qushairi Mohamad*[1], Ilyas Khan[2] Nor Athirah Mohd Zin[1], Zulkhibri Ismail[1], Sharidan Shafie[1] [1]Universiti Teknologi Malaysia [2]College of Engineering Majmaah University [S09-CT-15, p.444]
09.45 - 10.00	**Validation of a hyperbolic system of conservation laws for compressible two-phase flows** Dia Zeidan[1], Eric Goncalvès[2] [1]German Jordanian University, Jordan [2]Ensma - Pprime, Poitiers, France [S09-CT-16, p.445]

July 27 (Wed.)	**Room: Legian 2**
09.00 - 10.00	Chair: Thien Binh Nguyen
09.00 - 09.15	**Exact and numerical solutions of the wave equation with fractional time derivative** Thien Binh Nguyen*, Bongsoo Jang Ulsan National Inst. of Sci. & Tech., Republic of Korea [S09-CT-17, p.445]
09.15 - 09.30	**Asymptotic expansion and numerical simulation for gravity waves in a porous media** I. Magdalena Faculty of Math. and Natural Sciences ITB, Indonesia [S09-CT-18, p.446]
09.30 - 09.45	**Finite element solutions of the RAPM model for risk adjusted option pricing** Dongming Wei, Andrey Pak, Laila Zhexembay Kazakhstan Nazarbayev University [S09-CT-19, p.447]

09.45 - 10.00 **A preliminary study on time series forecasting electricity load demand using hybrid exponential smoothing-backpropagation model**
Winita Sulandari*[1], Subanar[2], Suhartono[3], Suherni[2]
[1]Sebelas Maret University, [2]Gadjah Mada University
[3]Sepuluh Nopember Institute of Technology [S09-CT-20, p.447]

July 27 (Wed.) **Room: Legian 1**

15.00 - 16.00 Chair: Zhiming Gao

15.00 - 15.15 **A second-order positivity-preserving finite volume scheme for diffusion equations on general meshes**
Zhiming Gao*, Jiming Wu
Inst. of Appl. Physics and Comput. Math., China [S09-CT-21, p.448]

15.15 - 15.30 **Magnetic zone model for semi-permeable cracks in piezoelectromagnetic media**
Kamlesh Jangid
Deptt. of HEAS (Mathematics), RTU, Kota, India [S09-CT-22, p.448]

15.30 - 15.45 **A fuzzy approaches to decision making**
Sunny Joseph Kalayathankal*[1,2], JohnT Abraham[3]
[1]Bharathiar University, India, [2]K.E.College, Mannanam, Kerala, India
[3]Bharatha Matha College, India [S09-CT-23, p.449]

15.45 - 16.00 **The modified S-iteration process for nonexpansive mappings in CAT(κ) spaces**
Prasit Cholamjiak
University of Phayao, Thailand [S09-CT-24, p.450]

July 27 (Wed.) **Room: Legian 2**

15.00 - 16.00 Chair: Jiming Wu

15.00 - 15.15 **Naive Bayes as opinion classifier to evaluate student's satisfaction based on student sentiment in twitter social**
Fahmi Candra Permana *[1]
Yusep Rosmansyah[2], Atje Setiawan Abdullah[1]
Universitas Padjadjaran, Indonesia [S09-CT-25, p.450]

15.15 - 15.30 **Quasigroup application in constructing 4X4 S-Box**
Gigih Bagus Pambekti[1], Sri Rosdiana*[2]
Indra Setia Rahmat[2], Caesario O. Kisty[2]
[1]Lembaga Sandi Negara, [2]Sekolah Tinggi Sandi Negara [S09-CT-26, p.451]

15.30 - 15.45 **Plane symmetric anisotropy cosmological models in modified gravity**
B. Mishra
Birla Inst. of Tech. and Science-Pilani [S09-CT-27, p.452]

15.45 - 16.00 **A family of vertex-centered linearity-preserving schemes for diffusion problems on arbitrary polygonal meshes**
Jiming Wu
Inst. of Appl. Physics and Comput. Math. Beijing [S09-CT-28, p.452]

July 28 (Thu.) **Room: Legian 1**

09.00 - 10.00 Chair: Abdullah Shah

09.00 - 09.15 **The synchronized traffic light schedule to the railways doorstop**
Tomi Tristono*, Setiyo Daru Cahyono, Pradityo Utomo
Universitas Merdeka Madiun [S09-CT-29, p.453]

09.15 - 09.30 **Stability switch and hopf-bifurcation in a delayed intraguild predation model**
Julius Fergy T. Rabago*, Juancho A. Collera
University of the Philippines Baguio [S09-CT-30, p.453]

09.30 - 09.45 **An artificial compressibility method for 3D phase field model and its application to two-phase flows**
Abdullah Shah
COMSATS Inst. of Information Technology [S09-CT-31, p.454]

09.45 - 10.00 **The pricing formula for callable European put options**
Hsuan-Ku Liu[1], Ting-Pin Wu[2], Jui-Jane Chang[3]
[1]National Taipei University, Taiwan
[2]National Central University, Taiwan
[3]Soochow University, Taiwan [S09-CT-32, p.455]

July 28 (Thu.) **Room: Legian 2**

09.00 - 10.00 Chair: Duong T. Pham

09.00 - 09.15 **A shape calculus based method for a transmission problem with a random interface**
Duong T. Pham[1], Alexey Chernov[2], Thanh Tran[3]
[1]Vietnamese German University, [2]Carl von Ossietzky University
[3]The University of New South Wales [S09-CT-33, p.455]

09.15 - 09.30 **Simulation of solid oxide fuel cell with temperature effect**
Sineenart Srimongkol
Burapha University [S09-CT-34, p.456]

09.30 - 09.45 **A new geometric method for ordering generalized trapezoidal fuzzy numbers and its application**
Handan Akyar
Anadolu University, Eskisehir, Turkey [S09-CT-35, p.456]

09.45 - 10.00 **Unsteady magnetohydrodynamics viscous fluid with forced convection flow past a sliced sphere**
I Gede Eva Purwanta Wijaya*, Basuki Widodo, Chairul Imron
Institut Teknologi Sepuluh Nopember [S09-CT-36, p.457]

July 28 (Thu.) **Room: Legian 1**

11.30 - 12.30 Chair: Wen Chean Teh

11.30 - 11.45 **Modified HPM for linear fractional integro-differential equations of Fredholm-Volterra type**
K. M. Hamson*[1], Z. K. Eshkuvatov[12], B. M. Taib[1]
[1]Universiti Sains Islam Malaysia (USIM)
[2]Universiti Putra Malaysia (UPM) [S09-CT-37, p.457]

11.45 - 12.00 **On M-unambiguity of Parikh matrices**
Wen Chean Teh
Universiti Sains Malaysia [S09-CT-38, p.458]

12.00 - 12.15 **Isometries and binary images of linear block codes over $\mathbb{Z}_{2^r} + u\mathbb{Z}_{2^r}$**
Virgilio Sison*, Monica Remillion
University of the Philippines Los Baños [S09-CT-39, p.458]

12.15 - 12.30 **A three-step iterative method free from derivative with sixth-order convergence for solving nonlinear equations**
Iin Purnama Edwar*, M. Imran, Leli Deswita
University of Riau [S09-CT-40, p.459]

July 28 (Thu.) **Room: Legian 2**

11.30 - 12.30 Chair: Rizavel Addawe

11.30 - 11.45 **A novel differential evolution algorithm and its application to molecular potential energy problem**
Pooja, Praveena Chaturvedi
Gurukula Kangri Vishwavidyalaya, Haridwar, India [S09-CT-41, p.459]

11.45 - 12.00 **On the design of Hennon map based on true random number generators**
Magfirawaty*, Suryadi, Kalamullah Ramli
Universitas Indonesia [S09-CT-42, p.460]

12.00 - 12.15 **Differential evolution-simulated annealing for multiple sequence alignment**
Rizavel Addawe*[1], Joel Addawe[1], Joselito Magadia[2]
[1]University of the Philippines Baguio
[2]University of the Philippines Diliman [S09-CT-43, p.460]

12.15 - 12.30 **A moving least squares method for X-ray image processing**
Yeon Ju Lee
Korea University Sejong Campus, Sejong, S. Korea [S09-CT-44, p.461]

July 28 (Thu.)	**Room: Legian 3**
11.30 - 12.30	Chair: Aiyub Khan
11.30 - 11.45	**Magnetohydrodynamic (MHD) unsteady nano fluid on the flowing boundary layer past a sliced sphere** Yunita Nur Afifah*, Basuki Widodo, Chairul Imron Institut Teknologi Sepuluh Nopember [S09-CT-45, p.461]
11.45 - 12.00	**Initial unsteady free convective flow past in an infinite vertical plate with radiation and mass transfer effects** Aiyub Khan Jai Narain Vyas University, Jodhpur, India [S09-CT-46, p.462]
12.00 - 12.15	**g-jitter induced mixed convection flow of Jeffrey fluid past an inclined stretching sheet** Noraihan Afiqah Rawi*, Mohd Rijal Ilias Zaiton Mat Isa, Sharidan Shafie Universiti Teknologi Malaysia [S09-CT-47, p.462]
12.15 - 12.30	**Numerical computation in solving the exterior Riemann-Hilbert problem on simply connected regions** Ummu Tasnim Husin*, Ali Hassan Mohamed Murid Mukhiddin Ishkobilovich Muminov [1]Universiti Teknologi Malaysia [S09-CT-48, p.463]

July 28 (Thu.)	**Room: Legian 2**
16.30 - 17.30	Chair: Jerrold M. Tubay
16.30 - 16.45	**Magnetohydrodynamics of unsteady micropolar fluid on boundary layer flow past a sliced sphere** Rita Ayu Ningtyas*, Basuki Widodo, Choirul Imron Institut Teknologi Sepuluh Nopember [S09-CT-49, p.463]
16.45 - 17.00	**Non-negative matrix factorization as a robust feature selection method for classification of dementia with MRI data** Devvi Sarwinda, Gianinna Ardaneswari*, Alhadi Bustamam Universitas Indonesia [S09-CT-50, p.464]
17.00 - 17.15	**Dynamic microhabitat locality allows multi-species coexistence in a lattice Lotka-Volterra model of terrestrial plant communities** Jerrold M. Tubay*[1], Jin Yoshimura[2] [1]Univ. of the Philippines Los Banos [2]Shizuoka University, Japan [S09-CT-51, p.465]
17.15 - 17.30	**Collision attack against Tav-128 hash function** Fajar Hariyanto*, Bety Hayat Susanti Sekolah Tinggi Sandi Negara [S09-CT-52, p.465]

July 29 (Fri.)	**Room: Legian 1**
08.30 - 10.00	Chair: Sunny Joseph Kalayathankal
08.30 - 08.45	**A survey on solution of minimum spanning tree using soft computing-based algorithm and its applications on logistic problems** Shinta Tri Kismanti*, Imam Mukhlash Institut Teknologi Sepuluh Nopember [S09-CT-53, p.465]
08.45 - 09.00	**Unsteady MHD second grade fluids flow with radiation effects** Zulkhibri Ismail[1], Ahmad Qushairi Mohamad[2], Ilyas Khan[3] Nadirah Mohd Nasir[1], Sharidan Shafie[2] [1]Universiti Malaysia Pahang, [2]Universiti Teknologi Malaysia [3]College of Engineering Majmaah Univ., Saudi Arabia [S09-CT-54, p.466]
09.00 - 09.15	**Estimating the relative fitness of competing bacterial populations: is Lenski method appropriate enough?** Faradillah Haryani Universitas Negeri Surabaya [S09-CT-55, p.467]
09.15 - 09.30	**MHD natural convection flow of ferrofluids along a vertical flat plate with newtonian heating** Mohd Rijal Ilias*[1,2], Noraihan Afiqah Rawi[1], Sharidan Shafie[1] [1]Universiti Teknologi Malaysia [2]Universiti Teknologi MARA, Malaysia [S09-CT-56, p.468]
09.30 - 09.45	**Robust algorithm for counting moving vehicle based on image processing** Reza Augusta Jannatul Firdaus*, Budi Setiyono, Dwi Ratna Sulistyaningrum Institut Teknologi Sepuluh Nopember [S09-CT-57, p.468]
09.45 - 10.00	**Hydromagnetic falkner-skan flow of Casson fluid past** Imran Ullah[1], Asma Khalid[1], Ilyas Khan[2], Sharidan Shafie*[1] [1]Universiti Teknologi Malaysia [2]Majmaah University, Saudi Arabia [S09-CT-58, p.469]

July 29 (Fri.)	**Room: Legian 2**
08.30 - 10.00	Chair: Arrianne Crystal T. Velasco
08.30 - 08.45	**Modeling of knowledge dissemination** Mukhsar*, Pantry Elastic, Edi Cahyono Universitas Halu Oleo, Kendari, Indonesia [S09-CT-59, p.470]
08.45 - 09.00	**Finite Element model of size, shape and blood pressure on rupture of intracranial saccular aneurysms** Jennica Rica Nabong*[1], Carmela Sales[2], Guido David[1] [1]University of the Philippines [2]Philippine General Hospital [S09-CT-60, p.470]

09.00 - 09.15 **Fluid dynamic in the continuous stirred tank using finite element methods**
Tulus*[1], O. S. Sitompul[1], Sawaluddin[1], R. Hasibuan[1], A. K. Ariffin[2]
[1]University of Sumatera Utara
[2]National Univiversity of Malaysia [S09-CT-61, p.471]

09.15 - 09.30 **Moving vehicle classification based on pixel quantity**
Bayu C. Putra*, Budi Setiyono, Imam Mukhlash, Dwi R. Sulistyaningrum
Institut Teknologi Sepuluh Nopember [S09-CT-62, p.471]

09.30 - 09.45 **Implementation of plaid model biclustering method on micro-array of carcinoma and adenoma tumor gene expression data**
Gianinna Ardaneswari*, Devvi Sarwinda, Alhadi Bustamam
Universitas Indonesia [S09-CT-63, p.472]

09.45 - 10.00 **A multigrid approach for state-constrained optimal control problem with bilinear state equation**
Arrianne Crystal T. Velasco*[1], Michelle C. Vallejos[2]
[1]University of the Philippines-Diliman
[2]Technische Universität Darmstadt [S09-CT-64, p.472]

July 29 (Fri.) **Room: Legian 1**

13.30 - 15.00 Chair: Mohd Rijal Ilias

13.30 - 13.45 **Super-resolution imaging applied to moving object tracking**
Galandaru Swalaganata*, Dwi Ratna Sulistyaningrum, Budi Setiyono
Institut Teknologi Sepuluh Nopember [S09-CT-65, p.473]

13.45 - 14.00 **New modified map for digital image encryption and its performance**
Suryadi M.T, Maria Yus Trinity Irsan*, Yudi Satria
Universitas Indonesia [S09-CT-66, p.474]

14.00 - 14.15 **Prediction DNA sequens in influenza a virus using hidden Markov models**
Harmuda Pandiangan*, M. Isa Irawan
Institut Teknologi Sepuluh Nopember Surabaya [S09-CT-67, p.474]

14.15 - 14.30 **An agent based model of the spread of radical ideology with some results of rehabilitation program**
Bevina D. Handari*, Hengki Tasman
Universitas Indonesia [S09-CT-68, p.475]

14.30 - 14.45 **Influence of aligned magnetic field on MHD natural convection flow of ferrofluids along a moving vertical flat plate**
Mohd Rijal Ilias*[1,2], Noraihan Afiqah Rawi[1], Sharidan Shafie[1]
[1]Universiti Teknologi Malaysia
[2]Universiti Teknologi MARA, Malaysia [S09-CT-69, p.476]

14.45 - 15.00 **A numerical method for time-dependent water absorption by plant roots**
Imam Solekhudin[1], Keng Cheng Ang[2]
[1]Universitas Gadjah Mada, [2]NIE-NTU, Singapore [S09-CT-70, p.476]

July 29 (Fri.)	**Room: Legian 2**
13.30 - 15.00	Chair: Linda Smail
13.30 - 13.45	**Junction tree construction techniques: application to Bayesian networks** Linda Smail Zayed University [S09-CT-71, p.477]
13.45 - 14.00	**A new generalized fuzzy multi-criteria decision making approach for solving green supplier selection problem** Luu Quoc Dat Viet Nam National University [S09-CT-72, p.478]
14.00 - 14.15	**The enumeration of Euclidean self-dual skew-cyclic codes over finite fields** Irwansyah*[1,2], Intan Muchtadi-Alamsyah[1] Djoko Suprijanto[1], Aleams Barra[1], Ahmad Muchlis[1] [1]Institut Teknologi Bandung [2]Universitas Mataram, Indonesia [S09-CT-73, p.478]
14.15 - 14.30	**Fuzzy functional and implication dependency using** Mohammad Deni Akbar*, Yoshihiro Mizoguchi Kyushu University [S09-CT-74, p.479]
14.30 - 14.45	**Mathematical model palatine rugae subras deuteromelayu in forensic dentistry** Sudradjat Supian*, H. Fahmi Oscandar, Intan Nurrsamsi Universitas Padjadjaran [S09-CT-75, p.480]
14.45 - 15.00	**Robust GK fuzzy clustering algorithms with cluster core and analysis on parameter selection** Winsy Weku*[1], Miin-Shen Yang[2] [1]Sam Ratulangi University, Indonesia [2]Chung Yuan Christian University, Taiwan [S09-CT-76, p.480]

Poster Session

July 26 (Tue.)	**Room: Pecatu Hall 3 and 5**
15.00 - 17.00	
15.00 - 17.00	**Surface wave analysis by wavelet transform** Sunjay, Manas Banerjee Geophysics, BHU, Varanasi-221005, India [S09-P-01, p.481]
15.00 - 17.00	**Activation functions comparison in higher order network** Saratha Sathasivam*[1], Muraly Velavan Doraisamy[2] [1]Universiti Sains Malaysia, Penang [2]AIMST University, Bedong, Kedah, Malaysia [S09-P-02, p.482]

July 26 (Tue.)	**Room: Pecatu Hall 3 and 5**
15.00 - 17.00	
15.00 - 17.00	**Short segment search method for phylogenetic analysis using nested sliding window** Afif Akbar Iskandar*[1], Alhadi Bustamam*[1], Hidayat Trimarsanto*[2] [1]Universitas Indonesia [2]Eijkman Institute for Molecular Biology [S09-P-03, p.483]
15.00 - 17.00	**The implementation of Self Organizing Maps (SOM) partitioning Algorithm in HOPACH Clustering Method** S. Wulandari, A. Bustamam, T. Siswantining Universitas Indonesia [S09-P-04, p.483]
15.00 - 17.00	**The implementation of fuzzy C-means partitioning algorithm in HOPACH clustering method** G. Suryawati*, A. Bustamam, D. Lestari Universitas Indonesia [S09-P-05, p.484]
15.00 - 17.00	**Student based course timetabling problem: a case study** San-Nah Sze, Chia-Lih Bong, Noor-Alamshah Bolhassan Kang-Leng Chiew, Wei-King Tiong FCSIT, Universiti Malaysia Sarawak [S09-P-06, p.485]
15.00 - 17.00	**A LTDRM with a predictor-corrector scheme for time-dependent infiltration from periodic channels at different types of homogeneous soils with root-water uptake** Millatuz Zahroh, I Solekhudin Gadjah Mada University, Indonesia [S09-P-07, p.485]
15.00 - 17.00	**Invigilator scheduling for faculty final examination** San-Nah Sze, Mei-Gie Teo, Kang-Leng Chiew, Wei-King Tiong FCSIT, Universiti Malaysia Sarawak [S09-P-08, p.486]

July 27 (Wed.)	**Room: Pecatu Hall 3 and 5**
08.30 - 10.00	
08.30 - 10.00	**Wavelet transform in computational fluid dynamics** Sunjay, Manas Banerjee Geophysics, BHU, varanasi-221005, India [S09-P-09, p.487]
08.30 - 10.00	**Spatial data mining for evaluation standards of quality education in West Java using semiparametric geographical regression model** Atje Setiawan Abdullah, I Gede Nyoman Mindra Jaya* Rudi Rosadi, Budi Nurani Ruchjana Universitas Padjadjaran, Indonesia [S09-P-10, p.488]
08.30 - 10.00	**Small object tracking using adaptive particle filter based on super-resolution** Yabunayya Habibi*, Dwi Ratna Sulistyaningrum, Budi Setiyono Institut Teknologi Sepuluh Nopember [S09-P-11, p.488]

July 27 (Wed.)	**Room: Pecatu Hall 3 and 5**
08.30 - 10.00	
08.30 - 10.00	**The similarity analysis of DNA sequence model based on graph theory and blast program** Y. A. Lesnussa*, S. Kappuw, B. P. Tomasouw University of Pattimura [S09-P-12, p.489]
08.30 - 10.00	**Data mining for classification naming of the village at Java island** Atje Setiawan Abdullah*, Akik Hidayat, Akmal Deni Setiana, Budi Nurani Ruchjana Universitas Padjadjaran, Indonesia [S09-P-13, p.490]
08.30 - 10.00	**Air pollution simulation in Baguio City, Philippines using genetic algorithm** Lee Javellana*, Joel Addawe University of the Philippines Baguio [S09-P-14, p.490]
08.30 - 10.00	**Face recognition using moment invariant and neural network** Asep Sholahuddin*, Setiawan Hadi Universitas Padjadjaran [S09-P-15, p.491]

July 27 (Wed.)	**Room: Pecatu Hall 3 and 5**
15.00 - 16.00	
15.00 - 16.00	**Innovation of hypocycloid curves into 3D-hypocs** H.A. Parhusip*[1], M.R.S. Shanti[2] Satya Wacana Christian University [S09-P-16, p.491]
15.00 - 16.00	**Fuzzy C-means inference system for students classification** L. Linawati*, H.A. Parhusip Satya Wacana Christian University [S09-P-17, p.492]
15.00 - 16.00	**Geographic information systems for mapping the National exam results of junior high school in 2014 at West Java province** Atje Setiawan Abdullah*, Juli Rejito, Rudi Rosadi, Fahmi Candra Permana I Gede Nyoman Mindra Jaya, Budi Nurani Ruchjana Universitas Padjadjaran, Indonesia [S09-P-18, p.492]
15.00 - 16.00	**Computation and simulation of fluid flow during retinal detachment** Lim Yeou Jiann*[1], Zuhaila Ismail[1], Sharidan Shafie[1], Alistair Fitt[2] [1]Universiti Teknologi Malaysia [2]Oxford Brookes Univ. Headington Campus, UK [S09-P-19, p.493]
15.00 - 16.00	**Image indexing using color histogram and K-means clustering for optimization CBIR in image database** Juli Rejito*, Atje Setiawan Abdullah, Akmal, Deni Setiana Budi Nurani Ruchjana Universitas Padjadjaran [S09-P-20, p.493]

July 27 (Wed.)	**Room: Pecatu Hall 3 and 5**
15.00 - 16.00	
15.00 - 16.00	**Some steganography methods for National maritime security** R Bisma Ramadhan*, Edy Tri Baskoro, Prima Roza Institut Teknologi Bandung [S09-P-21, p.494]
15.00 - 16.00	**Estimation of total loss and damage insurance premiums which causes the Citarum river flooding in south Bandung region Indonesia** Pramono Sidi*[1], Mustafa Mamat[2], Sukono[3], Sudradjat Supian[3] [1]Universitas Terbuka, [2]Universiti Sultan Zainal Abidin, Malaysia [3]Universitas Padjadjaran [S09-P-22, p.494]
15.00 - 16.00	**Computational study of electrical activities in subthalamic nucleus neuron: role of T-type calcium channel in Parkinson's disease** Chitaranjan Mahapatra*, Rohit Manchanda Indian Institute of Technology Bombay [S09-P-23, p.495]
15.00 - 16.00	**Correcting circular non-uniform illumination of Sundanese ethnoimage** S. Hadi*, M. Suryani, A.K. Supriatna Universitas Padjadjaran [S09-P-24, p.496]
15.00 - 16.00	**Sundanese ancient manuscripts search engine using probabilistic approach** Mira Suryani*, Setiawan Hadi Universitas Padjadjaran [S09-P-25, p.497]
15.00 - 16.00	**Preliminary study on binarization methods of ancient Sundanese manuscript images** Erick Paulus*, Mira Suryani, Setiawan Hadi Universitas Padjadjaran [S09-P-26, p.498]

July 28 (Thu.)	**Room: Pecatu Hall 3 and 5**
08.30 - 10.00	
08.30 - 10.00	**Intelligent communication language for the Indonesian maritime security** Prima Roza*, Tri Sulistyaningtyas, A. Wawan Jatnika, Edy Tri Baskoro Institut Teknologi Bandung [S09-P-27, p.498]
08.30 - 10.00	**Computing arbitrary real powers of a matrix by using number representation system** Yeon-Ji Kim*[1], Jong-Hyeon Seo[2], Hyun-Min Kim[1] [1]Pusan National University, [2]Dongseo University [S09-P-28, p.499]
08.30 - 10.00	**Stiffness detection technique for selecting adaptive step size in the parareal algorithm** Sunyoung Bu Hongik University, Korea [S09-P-29, p.499]

July 28 (Thu.)	**Room: Pecatu Hall 3 and 5**
08.30 - 10.00	
08.30 - 10.00	**Newton's method to solve a matrix equation with monotonicity** Young-Jin Kim, Geon-Woo Kim*, Hyun-Min Kim Pusan National University [S09-P-30, p.500]
08.30 - 10.00	**An iterative method with stepsize parameter for solving nonlinear matrix equations** Jie Meng*, Hyun-Min Kim Pusan National University [S09-P-31, p.500]
08.30 - 10.00	**Multicollsion attack on CBC-MAC, EMAC, and XCBC-MAC of AES-128 algorithm** Alfonso Brolin Sihite*, Bety Hayat Susanti Sekolah Tinggi Sandi Negara [S09-P-32, p.501]
08.30 - 10.00	**On the construction of L_2 orthogonal elements of arbitrary n order for local projection stabilizatio** Friedhelm Schieweck[1], Piotr Skrzypacz[2], Lutz Tobiska[1] [1]Otto von Guericke University of Magdeburg, Germany [2]Nazarbayev University, Astana, Kazakhstan [S09-P-33, p.501]
08.30 - 10.00	**Derivative estimation of triangular patch by using moving least square** Noorehan Awang*[1], Rahmita Wirza Rahmat[2] [1]University Putra Malaysia [2]Universiti Teknologi MARA, Malaysia [S09-P-34, p.502]

July 28 (Thu.)	**Room: Pecatu Hall 3 and 5**
16.00 - 17.30	
16.00 - 17.30	**SIMON-64, SPECK-64 and SIMECK-64 as pseudo random number generator with NIST test** Sofu Risqi Y.S, Susila Windarta National Crypto Institute [S09-P-35, p.502]
16.00 - 17.30	**A brief comparison between SIMON-32, SPECK-32 and SIMECK-32 with collision test** Sofu Risqi Y.S, Susila Windarta National Crypto Institute [S09-P-36, p.503]
16.00 - 17.30	**Correlation of M-equivalence and strong M-equivalence for Parikh matrices** Ghajendran Poovanandran*, Wen Chean Teh Universiti Sains Malaysia [S09-P-37, p.503]
16.00 - 17.30	**The implementation of k-means partitioning algorithm in HOPACH clustering method** K. R. Adzima*, A. Bustamam, D. Aldila Universitas Indonesia [S09-P-38, p.504]

July 28 (Thu.)	**Room: Pecatu Hall 3 and 5**
16.00 - 17.30	
16.00 - 17.30	**The implementation of self organizing maps (SOM) partitioning algorithm in HOPACH clustering method** S. Wulandari*, A. Bustamam, T. Siswantining Universitas Indonesia [S09-P-39, p.504]
16.00 - 17.30	**Strict avalanche criterion (SAC) test on KLEIN, L-BLOCK and PRESENT algorithms** Sofyan Reza Ferianto*, Rizki Anisa Riyanti, Annisa Dini Handayani Sekolah Tinggi Sandi Negara [S09-P-40, p.505]
16.00 - 17.30	**Quadratic investment portfolio without a risk-free asset based on value-at-risk** Sukono*, Sudradjat Supian, Dwi Susanti Universitas Padjadjaran [S09-P-41, p.506]

July 29 (Fri.)	**Room: Pecatu Hall 3 and 5**
08.30 - 10.00	
08.30 - 10.00	**A comparison of kernel logistic regression and backpropagation neural networks in prediction of financial distress** Riska Yanu Fa'rifah, Bobby Poerwanto*, Feri Padli University of Cokroaminoto Palopo [S09-P-42, p.506]
08.30 - 10.00	**Mathematical analysis of large scale cyber attacks: cyber war** Apeksha Prajapati*, Bimal Kumar Mishra Birla Institute of Technology, Mesra, Ranchi, India [S09-P-43, p.507]
08.30 - 10.00	**Some variant of Newton method with higher order convergence** Jivandhar Jnawali*, Chet Raj Bhatta Tribhuvan University, Kathmandu, Nepal [S09-P-44, p.508]
08.30 - 10.00	**Expected profit from revenue earning asset in a fishery industry with different environmental conditions** Hennie Husniah*[1], Asep K. Supriatna[2] [1]Langlangbuana University, [2]Padjadjaran University [S09-P-45, p.508]
08.30 - 10.00	**A new variant of deletion in languages: computed sequential deletion** Ahmad Firdaus Yosman*[1], Fong Wan Heng[1] Sherzod Turaev[2], Nor Haniza Sarmin[1] [1]Universiti Teknologi Malaysia [2]International Islamic University Malaysia [S09-P-46, p.509]
08.30 - 10.00	**Encryption and Decryption Teks.Txt using Expansion Hill Cipher Method and Programming C++** Akik Hidayat*, Rudi Rosadi, Akmal Universitas Padjadjaran, Indonesia [S09-P-47, p.509]
08.30 - 10.00	**Fuzzy conditional random fields for temporal data mining** Intan Nurma Yulita, Atje Setiawan Abdullah Universitas Padjadjaran [S09-P-48, p.510]

S10. Control Theory and Optimization

Invited Talks

July 26 (Tue.) **Room: Legian 3**

Chair: Shambhu Sharma

15.00 - 15.30 **The method of orienting curves for finding optimal paths in restricted areas**

Hoang Xuan Phu

Vietnam Academy of Science and Technology [S10-IT-01, p.511]

July 27 (Wed.) **Room: Legian 3**

Chair: Sotheara Veng

16.00 - 16.30 **Control problem in bilinear system**

Roberd Saragih

Institut Teknologi Bandung, Indonesia [S10-IT-02, p.512]

July 27 (Wed.) **Room: Legian 3**

Chair: W. J. R. M. Priyadarshana

15.00 - 15.30 **Robust Optimization Modelling with Applications to Industry and Environmental Problems**

Diah Chaerani

Universitas Padjadjaran, Indonesia [S10-IT-03, p.512]

July 28 (Thu.) **Room: Legian 3**

Chair: Syaiful Anam

08.30 - 09.00 **Fast algorithms for large scale generalized distance weighted discrimination**

Xin-Yee Lam[1], Steve Marron[2], Defeng Sun[1], Kim-Chuan Toh[*1]

[1]National University of Singapore

[2]University of North Carolina, Chapel Hill [S10-IT-04, p.513]

Contributed Talks

July 26 (Tue.)	Room: Legian 3
15.30 - 17.00	Chair: Shambhu Sharma
15.30 - 15.45	**Portfolio optimization based on stock return prediction for investment management strategy** Irma Fitria*[1], Erna Apriliani[2], Endah R. M. Putri[2], Subchan[2] [1]Kalimantan Institute of Technology [2]Institut Teknologi Sepuluh Nopember [S10-CT-01, p.514]
15.45 - 16.00	**Analysis of optimal control problem from MERS epidemics models with various intervention** K.Khotimah*, D. Aldila, H. Tasman, H. Padma Universitas Indonesia [S10-CT-02, p.514]
16.00 - 16.15	**Zero suffix method for quadratic transportation problem** Shambhu Sharma Dayalbagh Educational Institute, Agra, India [S10-CT-03, p.515]
16.15 - 16.30	**Control theory in optimizing smoking prevalence rate: an overview and potential solution** Tisya Farida Abdul Halim*, Hasimah Sapiri Norhaslinda Zainal Abidin Universiti Utara Malaysia, Kedah [S10-CT-04, p.515]
16.30 - 16.45	**Optimal control of diversification model rice and non-rice with target** Retno Wahyu Dewanti[1], Subchan[2] [1]Institut Teknologi Kalimantan [2]Institut Teknologi Sepuluh Nopember [S10-CT-05, p.516]
16.45 - 17.00	**The fractional calculus of operator valued function with application to control theory** Mardiyana and Riyadi Sebelas Maret University, Indonesia [S10-CT-06, p.517]

July 27 (Wed.)	Room: Legian 3
09.00 - 10.00	Chair: Sotheara Veng
09.00 - 09.15	**From heuristic to deterministic: a two step approach to the tomography problem** Renier Mendoza University of the Philippines Diliman [S10-CT-07, p.517]
09.15 - 09.30	**Newton method for solution of generalized algebraic Riccati equation in linear quadratic dynamic game with feedback** Salmah*, Kirtyana Nindita Gadjah Mada University, Indonesia [S10-CT-08, p.518]

09.30 - 09.45 **Portfolio optimization under a combined model of stochastic volatility and constant elasticity of variance**
Sotheara Veng*, Jai Heui Kim
Pusan National University [S10-CT-09, p.518]

09.45 - 10.00 **Vector optimization and vector variational-like inequalities in terms of convexificators**
Yadvendra Singh, S. K. Mishra
Banaras Hindu University, India [S10-CT-10, p.519]

July 27 (Wed.) **Room: Legian 3**

15.30 - 16.00 Chair: W. J. R. M. Priyadarshana

15.30 - 15.45 **breakpoint: an R package to detect multiple change-points in continuous and count data via the cross-entropy method**
W. J. R. M. Priyadarshana *[1], G. Sofronov[2]
Endah R. M. Putri[2], Subchan[2]
[1]Swinburne University of Technology, Australia
[2]Macquarie University, Sydney, Australia [S10-CT-11, p.519]

15.45 - 16.00 **Shortest path problem on a grid network with unordered intermediate points**
Veekeong Saw, Amirah Rahman, Wen Eng Ong*
Universiti Sains Malaysia [S10-CT-12, p.520]

July 28 (Tue.) **Room: Legian 3**

09.00 - 10.00 Chair: Syaiful Anam

09.00 - 09.15 **Optimal solution strategy for University Course Timetabling Problem**
Chacha Stephen*[1], Allen Rangia Mushi[2]
[1]Pusan National University, Korea
[2]University of Dar es salaam, Tanzania [S10-CT-13, p.521]

09.15 - 09.30 **The modification of hybrid method of ant colony optimization, particle swarm optimization and 3-Opt algorithm in traveling salesman problem**
Hertono, G.F, Handari, B.D., Ubadah, Silaban, D
Universitas Indonesia [S10-CT-14, p.521]

09.30 - 09.45 **Optimal control of tumor growth with combination of chemotherapy and herbal therapy in myeloma bone disease**
Rizki Fauziah *, Mardlijah
Institut Teknologi Sepuluh Nopember, Indonesia [S10-CT-15, p.522]

09.45 - 10.00 **Multimodal optimization by using hybrid of artificial bee colony algorithm and BFGS algorithm**
Syaiful Anam*
Brawijaya University, Indonesia [S10-CT-16, p.522]

July 28 (Thu.) **Room: Legian 3**

16.30 - 17.15 Chair: Phan Thanh An

16.30 - 16.45 **Method of orienting curves for computational geometry**
Phan Thanh An*
University of Lisbon [S10-CT-17, p.523]

16.45 - 17.00 **Optimal strategy for supplier selection problem integrated with optimal control problem of single product inventory system with piecewise holding cost**
Sutrisno*, Widowati, R. Heru Tjahjana
Diponegoro University, Indonesia [S10-CT-18, p.524]

17.00 - 17.15 **Interior-point algorithms for $P_*(\kappa)$-horizontal linear complementarity problems**
Gyeong-Mi Cho[1], You-Young Cho[2]
[1]Dongseo University, [2]Pusan National University [S10-CT-19, p.524]

Poster Session

July 28 (Tue.) **Room: Pecatu Hall 3 and 5**

08.30 - 10.00

08.30 - 10.00 **Construction of interval linear programming with interior point methods**
Agustina Pradjaningsih, Herry Suprajitno[2], Fatmawati[2]
[1]Jember University, Indonesia
[2]Airlangga University, Indonesia [S10-P-01, p.525]

08.30 - 10.00 **A case study in timetabling problem using integer linear programming (ILP) model**
Nur Aishah Ramli*, Syarifah Zyurina Nordin
Universiti Teknologi Malaysia [S10-P-02, p.525]

08.30 - 10.00 **Combination of an inertial measurement unit and a camera for defining the position of an airplane**
Quang Vinh Nguyen
Vietnam Academy of Military Science and Technology [S10-P-03, p.526]

08.30 - 10.00 **Parallel-post-hybrid genetic algorithm and quasi newton BFGS**
Zuraidah Fitriah[1], Liza Tridiana M[2]
[1]Universitas Brawijaya, [2]Wisnuwardhana University [S10-CT-04, p.526]

08.30 - 10.00 **Out-of-sample performance of robust mean-variance portfolio**
Epha Supandi*[1], Dedi Rosadi[2], Abdurakhman[2]
[1]UIN Sunan Kalijaga, Indonesia
[2]University of Gadjah Mada, Indonesia [S10-P-05, p.527]

08.30 - 10.00 **Second order cone programming norm 1**
Caturiyati[1], Ch. Rini Indrati[2], Lina Aryati[2]
[1]Yogyakarta State University, Indonesia
[2]Gadjah Mada University, Indonesia [S10-P-06, p.527]

July 29 (Fri.)	Room: Pecatu Hall 3 and 5
08.30 - 10.00	
08.30 - 10.00	**Bi-objective mathematical model for finding the optimal time for sugarcane harvest in Thailand** Surattana Sungnul*, Santipong Prasattong Wisanlaya Pornprakun, Chanasak Baitiang King Mongkut's University of Technology North Bangkok [S10-P-07, p.529]
08.30 - 10.00	**Fuzzy mixed integer programming for land use planning in Tumauini, Isabela Philippines** Destiny S. Lutero*, Alleli Ester C. Domingo Guillermo A. Mendoza, Genaro A. Cuaresma University of the Philippines Los Banos [S10-P-08, p.529]
08.30 - 10.00	**On the lowest unique bid auction with multiple bids** Parkpoom Phetpradap*, Nawapon Nakharutai Chiang Mai University, Thailand [S10-P-09, p.530]
08.30 - 10.00	**Properties and approximate construction of the set of trajectories of the control system with integral constraint on the control functions** Huseyin N[1], Huseyin A[1], Guseinov Kh.G.*[2] [1]Cumhuriyet University, Turkey [2]Science Faculty, Anadolu University, Turkey [S10-P-10, p.530]
08.30 - 10.00	**Optimal control of performance in institute of court with maximum principle pontryagin method** Cynthia Alvionita Ferima*, Mardlijah Sepuluh Nopember Institute Of Technology Surabaya [S10-P-11, p.530]
08.30 - 10.00	**Analysis of resampled efficient frontier based on multiobjective portfolio** Abdurakhman Abdurakhman Mathematics UGM, Indonesia [S10-P-12, p.531]
08.30 - 10.00	**Completion of linear programming problem using a primal-dual exterior point and shortest path** Elis Ratna Wulan*, Irfan Abdul Muhaemin State Islamic University Bandung [S10-CT-13, p.531]
08.30 - 10.00	**Balikpapan's city transport scheduling using max-plus algebra** Winarni[1], Kistosil Fahim[2], Subchan[1] [1]Kalimantan Institute of Technology [2]Institut Teknologi Sepuluh Nopember [S10-CT-14, p.532]

1. SEAMS Council Meeting

Tuesday, July 26, 2016, 15.00 – 17.00

Mengwi VVIP

2. Mathematics Union Asia Forum

Wednesday, July 27, 2016, 16.00 – 17.30

Pecatu Hall 1 and 2

3. Asian Woman Mathematics Forum

Thursday, July 28, 2016, 16.00 – 18.30

Pecatu Hall 1 and 2

Asian Women Mathematicians Forum 2016

Time	Activity	PIC
12.30 – 13.30	Lunch/Registration	Kiki A. Sugeng/ OC
16.00 – 16.15	Opening	Budi Nurani Ruchjana
16.15 – 16.30	Photo Session	OC

Time	Topic	Speakers
16.30 – 17.15	Sharing of Woman Mathemacians Activity	Motoko Kotani (Japan) Sunsook Noh (Korea) Karin Baur (Austria) Ana Bela Cruzeiro (Portugal) Chair: Intan Muchtadi
17.15-18.00	Sharing of Woman Mathematicians Problem in South East Asian Countries	Polly Sy(Philipine) Wanida Hemakul (Thailand) Maslina Darus (Malaysia) Diah Chaerani (Indonesia) Chair: Hilda Assiyatun
18.00-18.15	Discussion and Summary	Sri Wahyuni
18.15-18.30	Closing	Kiki Ariyanti Sugeng

The Asian Mathematical Conference 2016

Abstracts

PL. Plenary Lectures

(* : Speaker)

PL-01. Small (and large) gaps between primes

James Maynard
University of Oxford, United Kingdom of Great Britain and Northern Ireland
jamesmaynard@hotmail.co.uk

Many of the most famous and most important questions on the distribution of primes can be cast as solving systems of linear equations with prime variables. The twin prime conjecture, Goldbach's conjecture, k-term arithmetic progressions of primes and most questions about small gaps between primes can all be seen in this manner, as well as several questions with applications to diophantine geometry or cryptography.

We will describe some of the progress on these questions, with a particular emphasis on establishing weak forms of some of these questions which has led to new results on bounded gaps between primes and large gaps between primes, amongst other things.

2010 Mathematics Subject Classification: 11A41, 11N80, 11P32.
Keywords: prime numbers, twin prime conjecture, Goldbach's conjecture.

PL-02. Number of Zeros of Multivariate Polynomials over Finite Fields

Sudhir R. Ghorpade
Indian Institute of Technology Bombay, India
srg@math.iitb.ac.in

A univariate polynomial of degree d with coefficient in a field $\mathbb{F}$ has at most d zeros in $\mathbb{F}$. Likewise, a bivariate homogeneous polynomial of degree d over $\mathbb{F}$ has at most d non-proportional zeros in $\mathbb{F}^2 \setminus \{(0,0)\}$ or in other words, at most d zeros in the projective space $\mathbb{P}^1(\mathbb{F})$. However, multivariate polynomials will, in general, have infinitely many zeros. But when $\mathbb{F}$ is the finite field $\mathbb{F}_q$ with q elements, it makes sense to ask for similar degree-based bounds on the number of zeros of one or more multivariate polynomials of given degrees. We consider in particular, the following question. Let r, d, m be positive integers and let $S := \mathbb{F}_q[x_0, x_1, \ldots, x_m]$ denote the ring of polynomials in $m+1$ variables with coefficients in $\mathbb{F}_q$ and $\mathbb{P}^m = \mathbb{P}^m(\mathbb{F}_q)$ the m-dimensional projective space over $\mathbb{F}_q$.

Question: What is the maximum number, say $e_r(d, m)$, of common zeros that a system of r linearly independent homogeneous polynomials of degree d in S can have in $\mathbb{P}^m(\mathbb{F}_q)$?

A remarkable conjecture by Tsfasman and Boguslavsky made about two decades ago predicted an explicit and rather complicated formula for $e_r(d, m)$ at least when $d < q-1$. This was already known to be valid in the case $r = 1$, thanks to the results of Serre (1991) as well as Sørensen (1991), The conjectured formula for $e_r(d, m)$ was shown to be true in the case $r = 2$ by Boguslavsky (1997). In this talk, we will outline these developments and report on a recent progress in a joint work with Mrinmoy Datta where we show that the Tsfasman-Boguslavsky Conjecture holds in the affirmative if $r \leq m + 1$ and is false in general if $r > m + 1$. We will also mention some newer conjectures and results that are partly obtained in collaboration with Peter Beelen and Mrinmoy Datta.

2010 Mathematics Subject Classification: Primary 14G15, 11T06, 11G25, 14G05
Secondary 51E20, 05B25
Keywords: finite field, projective space, multivariate polynomial.

PL-03. Taming infinities

Martin Hairer
Department of Mathematics, The University of Warwick
m.hairer@warwick.ac.uk

Some physical and mathematical theories have the unfortunate feature that if one takes them at face value, many quantities of interest appear to be infinite! Various techniques, usually going under the common name of "renormalisation" have been developed over the years to address this, allowing mathematicians and physicists to tame these infinities. We will tip our toes into some of the mathematical aspects of these techniques and we will see how they have recently been used to make precise analytical statements about the solutions of some equations whose meaning was not even clear until now.

2010 Mathematics Subject Classification: 03F50.
Keywords: mathematical theories, infinities.

PL-04. Noncommutative real algebraic geometry of Kazhdan's property (T)

Narutaka Ozawa
Kyoto University, Japan
narutaka@kurims.kyoto-u.ac.jp

Kazhdan's property (T) is a representation-theoretic property of groups, which was introduced by Kazhdan in 1967, but has found numerous applications in an amazingly large variety of subjects from representation theory and ergodic theory to combinatorics (expanders) and the theory of networks. I will start with a gentle introduction to the emerging subject of "noncommutative real algebraic geometry," a subject which deals with equations and inequalities in noncommutative algebras over the reals, with the help of analytic tools such as representation theory and operator algebras. I will then present a surprisingly simple proof that a group G has property (T) if and only if a certain inequality in the group algebra $\mathbf{R}[G]$ is satisfied. This inequality is rather amenable to computer-assisted analysis and would be useful in finding new examples of property (T) groups or better bounds of the Kazhdan constants of known property (T) groups.

2010 Mathematics Subject Classification: 22D40, 47A67, 14P05.
Keywords: Kazhdan's property, algebraic geometry, ergodic theory, representation theory.

PL-05. Motives with Galois group of type G_2-construction of Gross and Savin revisited

Sug Woo Shin
Department of Mathematics, UC Berkeley, USA
swshin@math.berkeley.edu

Serre asked whether there exists a motive (over Q) with Galois group G_2. Put it in another way, the question is to find (a compatible family of) ell-adic Galois representations whose image has Zariski closure G_2. This has been answered affirmatively since 2010 by Dettweiler and Reiter, Khare-Larsen-Savin, Yun, and Patrikis (including generalizations to exceptional groups other than G_2). In this talk I revisit the construction of Gross-Savin (which was conditional when proposed in 1998) which aims to realize such a motive in the cohomology of a Siegel modular variety of genus 3 via exceptional theta correspondence between G_2 and $PGSp_6$. Then I will explain that the construction is now unconditional due to my recent work with Arno Kret on the construction of$GSpin(2n+1)$-valued Galois representations in the cohomology of Siegel modular varieties.

2010 Mathematics Subject Classification: 11E72, 11R34.
Keywords: Galois group, cohomology.

PL-06. Fractional integrals and Morrey spaces

Hendra Gunawan
Bandung Institute of Technology, Indonesia
hgunawan@math.itb.ac.id

The talk will consist of two parts. In the first part, I will give a brief survey on Hardy-Littlewood maximal operator and fractional integral operators, especially about their boundedness properties on (generalized) Morrey spaces. The two operators were intially studied by G. Hardy & J. Littlewood and M. Riesz in the 1920's and the 1930's. Their boundedness on Morrey spaces was first proved by D. Adams and also by F. Chiarenza and M. Frasca in the 1970's and the 1980's. The results were generalized among others by E. Nakai in 1995, and I will present some recent results in this direction to indicate how 'hot' the topic is in the last two decades. In the second part, I will talk about basic but important properties of Morrey spaces, namely their inclusion properties. Here I will present some recent results not only for the 'strong' Morrey spaces but also weak type Morrey spaces, including their generalized versions. I shall also present some related results, and mention some future works.

2010 Mathematics Subject Classification: 42B35, 42B25, 46E30.
Keywords: maximal operator, fractional integrals, Morrey spaces, inclusion properties.

PL-07. Twisted Bhargava cubes and boxes

Gan Wee Teck
National University of Singapore
matgwt@nus.edu.sg

In his groundbreaking thesis work from 2001, Manjul Bhargava has extended Gauss's composition laws for binary quadratic forms to higher degree forms. One crucial ingredient in his work is the parametrisation of the orbits of lattice points in a prehomogeneous vector space by quantities of arithmetic interest. Using the $SL(2,Z) \times SL(2,Z) \times SL(2,Z)$-action on $2 \times 2 \times 2$ cubes, he gave a simpler description of Gauss's law, and using the $SL(2,Z) \times SL(3,Z) \times SL(3,Z)$-action on $2 \times 3 \times 3$boxes, he discovered a composition law on binary cubic forms. In this lecture, we revisit these two orbit problems over fields (rather than integers) and consider twisted versions of them. In particular, we shall discuss the question: what are the orbits parametrised by?

2010 Mathematics Subject Classification: 11E16.
Keywords: binary quadratic forms, orbit.

PL-08 Random functions

Van H. Vu
Yale University
van.vu@yale.edu

Studying the zeroes of a function and its derivates (local maxima and minima, saddle points etc) is among the most basic and important problems in mathematics. Needless to say, there are hundreds of theorems on the topic, many give valuable information in some special cases, while being totally useless in others. There are no universally good estimates. In this talk, I am going to tell the story about what happens in the average case, namely when our function is random, following the footsteps of Littlewood, Offord, Kac, Erdos, Ibragimov and many leading mathematicians of the last century, and concluding with a current development that finished of some of the most basic problems.

2010 Mathematics Subject Classification: 42B25.
Keywords: zeroes of a function, random functions.

PL-09. Recent progress on multiplier ideal sheaves and optimal L^2 extensions

Zhou Xiangyu
Institute of Mathematics, Chinese Academy of Sciences
xyzhou@math.ac.cn

In this talk, we will present our recent proof of Demailly's strong openness conjecture about multiplier ideal sheaves, solution of optimal L^2 extension problem, and their applications.

2010 Mathematics Subject Classification: 14F10.
Keywords: Demailly's strong openness conjecture, ideal sheaves.

SL. Special Lectures

(* : Speaker)

SL-01. On a tensor-analogue of the Schur product

V. S. Sunder*, K. Sumesh
Institute of Mathematical Sciences at Chennai, India
sunder@imsc.res.in

We consider the tensorial Schur product $R \circ^{\otimes} S = [r_{ij} \otimes s_{ij}]$ for $R \in M_n(\mathcal{A}), S \in M_n(\mathcal{B})$, with $\mathcal{A}, \mathcal{B}$ unital C^*-algebras and $R \circ^{\otimes} S$ viewed as an element of $M_n(\mathcal{C})$ for any C^*-algebra $\mathcal{C}$ containing the algebraic tensor product $\mathcal{A} \otimes_{alg} \mathcal{B}$; verify that such a 'tensorial Schur product' of positive operators is again positive and then use this fact to prove (an apparently marginally more general version of) the classical result of Choi that a linear map $\phi : M_n \longrightarrow M_d$ is completely positive if and only if $[\phi(E_{ij})] \in M_n(M_d)^+$, where of course $\{E_{ij} : 1 \leq i, j \leq n\}$ denotes the usual system of matrix units in $M_n(:= M_n(\mathbb{C}))$. We also discuss some other corollaries of the main result.

SL-02. Indonesia's maritime vision: The global maritime fulcrum

Desi Albert Mamahit
Badan Keamanan Laut Republik Indonesia
desimamahit@yahoo.com

The Indonesian President Joko Widodo concept of a "global maritime fulcrum" as the centerpiece of his administration is fundamentally represents a national vision and development agenda to rebuild the country's maritime culture and expand its economy. Jokowi strongly believes the future of Indonesian prosperity rests on the revival of its maritime culture. The concept also signifies a new strategic doctrine that projects Indonesia to become a maritime power with considerable diplomatic influence. The global maritime fulcrum includes five pillars: reviving Indonesia's maritime culture as a basis of national identity; developing the fisheries industry and food security; boosting Indonesia's maritime economy; using maritime diplomacy to mitigate security concerns; and protecting Indonesia's sovereignty by bolstering maritime defenses.

The realization of President Joko Widodo's maritime doctrine entails the maintenance of national sovereignty, maritime safety and regional security. However, issues of illegal fishing, smuggling, drug trafficking and piracy or robberies at sea are particularly salient in Southeast Asia. The persisting territorial disputes over

the South China Seas have led to rising maritime tensions and intensified major power rivalries. And, also the radicalism and terrorism remain at the forefront of Indonesia's domestic security concerns.

Against this backdrop, the paper seeks to explore the impact of Indonesia's maritime vision in foreign and defense policy. It will explore the concept of "global maritime fulcrum" and examine the strategic challenges facing the Indonesian Government for the next five years. The paper concludes by highlighting potential areas for defense and security cooperation between Indonesia and its strategic partners.

SL-03. Actuarial science program development in Indonesia

Rianto Ahmadi Djojosugito
Society of Actuaries of Indonesia
rianto.djojosugito@gmail.com

Gap between demand for actuarial human resources in the industries and supply of them is significant in Indonesia. Description of the problem and effort to minimize the gap including institutionalization of actuarial science program in appropriate universities in Indonesia as well as challenges faced in the effort are shared.

Abstracts of Sections S01 - S10

(* : Speaker)

S01. Logic and Foundations / Mathematics Education / History of Mathematics

Invited Talks

IT-01. Reverse mathematics and Ramsey's theorem

Yue Yang
National University of Singapore
matyangy@nus.edu.sg

Reverse mathematics is an active research area in mathematical logic and foundations of mathematics. Its goal is often stated as finding out "what set existence axioms are needed to prove the theorems of ordinary, classical (countable) mathematics". In this talk, I will explain why logicians are interested in this goal. I will use the study of Ramsey's Theorem as the main example.

Ramsey's Theorem is a well-known theorem in combinatorics, which states that for any function $f : [\mathbb{N}]^n \to \{0, 1, \ldots, k-1\}$, there is an infinite set $H \subseteq \mathbb{N}$ such that f is a constant on $[H]^n$. Here $[A]^n$ denotes the collection of n-element subsets of A, and this version of Ramsey's Theorem is denoted as RT^n_k. In reverse mathematics, it turns out that RT^2_2 - the Ramsey's theorem for pairs - is the most interesting and the most difficult. I will introduce the background and speak about some resent progresses. In particular, I will mention the result that the stable version of RT^2_2 does not imply the general version, which is a joint work with C. T. Chong from National University of Singapore and Theodore Slaman from University of California, Berkeley.

2010 Mathematics Subject Classification: 03B30, 03F35.
Keywords: reverse mathematics, Ramsey's theorem for pairs, nonstandard model of arithmetic.

IT-02. Continuous definable Skolem functions in d-minimal expansions of the real field

Athipat Thamrongthanyalak
Dept. of Mathematics and Comp. Sci., Chulalongkorn University, Thailand
Dept. of Mathematics, Ohio State University, Columbus, Ohio, USA
t.athipat@gmail.com

Let $\mathbf{R}$ be an expansion of the real field. We say that $\mathbf{R}$ is d-minimal if, in every structure elementarily equivalent to $\mathbf{R}$, every unary definable set is a finite disjoint union of open sets and discrete sets. Assume $\mathbf{R}$ is d-minimal. As a consequence of an analog of Cell Decomposition Theorem, $\mathbf{R}$ admits definable Skolem functions which are piecewise continuous. However, we cannot always find definable continuous Skolem functions for every definable family. We show that a definable family $(F_x)_{x\in X}$ of subsets of $\mathbb{R}^n$ admits continuous Skolem functions if it is lower semi-continuous (that is, for every $x \in X$ and $y \in F_x$, for every neighborhood V of y, there is a neighborhood U of X such that $F_z \cap V \neq \emptyset$ for every $z \in U$.)

2010 Mathematics Subject Classification: 03C64, 14P15, 32B20.
Keywords: d-minimality, o-minimality, selection theorem, set-valued map.

IT-03. Addressing issues on (university) mathematics education via collaborative professional development

Levi Esteban Elipane
Science Education Department, De La Salle University, Manila
Institute of Mathematics, College of Science University of the Philippines
School of Everlasting Pearl, Inc. Mambugan, Antipolo City
levielipane@yahoo.com

This lecture will delve on the issues that surround mathematics education in the Philippines, especially in the context of university mathematics. Anchoring on the Anthropological Theory of Didactics, issues and concerns on the what mathematics and how mathematics is being thought would be exemplified. In this light, implications on how the realities of 21st century learners place new demands on the character and quality of teaching. The talk will culminate with a suggestion about a very promising and very powerful professional development model that originated from Japan: Lesson Study. The model is deemed to systematically afford collaboration amongst mathematics educators, mathematicians, curriculum developers and enactors in order to come up with mathematics instruction that would bring about meaningful mathematics learning among the students.

2010 Mathematics Subject Classification: 97D80, 97C30.
Keywords: lesson study, mathematics learning.

IT-04. Structured professional development programs for fostering mathematics teacher professionalism

Yaya S. Kusumah
Dept. of Mathematics Education, Universitas Pendidikan Indonesia, Bandung
yskusumah@upi.edu, yayaskusumah@yahoo.com

Learning is an integrated and complex process, and so is learning about mathematics teaching. Learning and teaching competency are not easy for teachers to accomplish. For the sake of innovation of mathematics teaching, however, teachers need to be involved simultaneously in the study of mathematics and teaching mathematics, and they should strive to integrate theory into practice for achieving this goal. They need to know the knowledge of students' understandings and their ways of thinking, for constructing important and relevant mathematical tasks. Teachers need to strengthen their competency and implement their professional knowledge in meaningful mathematical context for enhancing students' mathematical understanding, reasoning, multiple representation, and problem solving, using symbolic, formal and technical language and operations.

To empower students, teachers need to move from the current practice of teaching and seek shifts in handling classroom management, treating students, approaching concepts of mathematics, stimulating students, presenting problems from daily life, as well as encouraging students to be a good problem solver. Further, teachers should create the climate of discussion and students' activity which are devoted to learning by doing (exploring concepts, constructing conjectures, posing arguments, providing mathematical evidence, verifying results, examining all possible procedures or answers, constructing generalizations, and reducing an emphasis on a mechanistic answer-finding).

For the enhancement of their professional development, mathematics teachers also need opportunities to attend some educational meetings where they can develop their own professional in collegial interactions; develop and apply various methods, strategies, models, and approaches; and learn best practices from reflection sessions based on their teaching and other teachers' experience.

Standard for professional development of mathematics teachers underlines the importance of pre-service and in-service program for mathematics teachers. This standard is not only devoted for programs in the beginning level of mathematics teachers' career, but also for further programs which provide advance mathematics, advance seminars and workshops, or programs for sharing ideas and experiences in mathematical contexts.

In this talk, some findings based on observations during teaching practices on mathematics will be revealed and discussed.

2010 Mathematics Subject Classification: 97C70.
Keywords: structured professional development, mathematical learning, teaching and learning process, collegial interactions, teaching competency.

Contributed Talks

CT-01. Investigation of contingency patterns of teachers' scaffolding in teaching and learning mathematics

Anwar*[1], Ipung Yuwono[2], Edy Bambang Irawan[2], Abdur Rahman As'ari[2]
[1]Syiah Kuala University, Banda Aceh, [2]State University of Malang
anwarramli@unsyiah.ac.id, {ipungmat, edy.bambang.fmipa, abdur.rahman.fmipa}@um.ac.id

The purpose of this study is to investigate the patterns of scaffolding contingency in teaching and learning mathematics carried out by three teachers. Contingency patterns were obtained by examining the transcription of conversation fragments between teachers and students during the provision of scaffolding. The fragments were recorded by a video recorder. The result shows that the three teachers expressed different interaction contingencies in their scaffolding activities, which are contingent dominant, non-contingent dominant, and pseudo-contingent. In addition, the learning interaction performed by experienced teachers tends to be contingent dominant compared to novice teachers.

2010 Mathematics Subject Classification: 97B50.
Keywords: contingency, contingent dominant, non-contingent dominant, pseudo-contingent, scaffolding.

CT-02. Comparing efficacy of pedagogical techniques using nonlinear mathematical models

Fedor Duzhin*[1], Artyom Markin[2], Katya Vladislavleva[2]
[1]Nanyang Technological University, [2]Evolved Analytics
fduzhin@ntu.edu.sg, {artem, katya}@evolved-analytics.be

A variety of innovative pedagogical strategies have become available recently, such as clickers, online homework, flipped classroom, collaborative tutorials, educational games, and more. High cost of some of the educational instruments needs to be justified, while the pedagogical value of these instruments is hard to evaluate directly. We developed a method that allows institutions and educators to compare the effectiveness of pedagogical techniques.

In classroom, we created a learning environment where students were encouraged to choose their preferred learning activity, clickers or homework. Then we constructed a mathematical model that predicts students' exam scores from history of grades in previous courses. The results show that the group of students who had preferred clickers to homework, on the average, over-performed the prediction while the group of students who had preferred homework under-performed the prediction. We argue that it is explained by the fact that clickers are a more effective instructional instrument than homework.

Applying the same method to another data set, we found that collaborative tutorials are more effective than clickers, although here the difference is not statistically significant.

Our method will be useful to a variety of institutions, education researchers, and instructors since it is simple, entirely data-driven, independent of discipline, and allows to reliably analyze relatively small data sets.

2010 Mathematics Subject Classification: 97D40, 97U70.
Keywords: education, clickers, flipped classroom, learning analytics.

CT-03. Preliminary investigation of prospective mathematics teachers' critical thinking disposition

Abdur Rahman As'ari
Department of Mathematics Education, State University of Malang, Indonesia
ar.asari@yahoo.com

Scholars have identified the need of developing 4Cs (Critical thinking, Collaboration, Communication, and Creativity) to confidently face and resolve challenging problems in the global era. Teachers are encouraged to promote these 4Cs, especially through modeling the skills and dispositions in front of their students. Through this article, the author reported the implementation of three case studies investigating prospective mathematics teachers? readiness to exhibit critical thinking dispositions. Three levels of critical thinkers were identified from these prospective mathematics teachers, namely: non-critical thinker, emerging critical thinker, and developing critical thinker. Majority of prospective mathematics teachers? critical thinking disposition is at the non-critical thinker level. Only a few of them are at the emerging critical thinker level, and very rare of them are at the developing critical thinker level. Therefore, prospective mathematics teachers need to be trained about critical thinking skills and how to consistently exhibit the critical thinking dispositions during the learning and teaching mathematics sessions.

2010 Mathematics Subject Classification: 97B50, 97C70.
Keywords: critical thinking, disposition, mathematics, prospective teacher, skills.

CT-04. Analysis of field dependent-prospective teacher's mathematical problem solving based on taxonomy of reflective thinking

Agustan[1], Dwi Juniati[2]
[1]Faculty of Teacher Training and Edu., Universitas Muhammadiyah Makassar
[2]Department of Mathematics, Universitas Negeri Surabaya
agus.sahabat@gmail.com, dwi_juniati@yahoo.com

Type of thinkings that can be applied in teaching mathematics is reflective thinking, for reflective thinking is a type of high-level thinking is to encourage the curiosity of students and shows the relationship between the learning materials.

One model of reflective thinking is taxonomy of reflective thinking which aims to see someone with a reflective thinking skill by checking, evaluating or testing the truth of a task or solving a problem which someone has done. Subject in this study is student who has cognitive style Field Dependent and enrolled as a student of Mathematics Education, University of Muhammadiyah Makassar. The purpose of this study is to analyze the ability of prospective teachers' mathematical problem solving based on taxonomy of reflective thinking. To achieve these objectives used a qualitative approach to describe in depth related problem-solving ability prospective teachers who can be seen from the behavior of students in completing the tasks assigned by the taxonomy of reflective thinking. There are six characteristics to analyze data related to the taxonomy of reflective thinking in solving mathematical problems; (1) remembering, (2) understanding, and (3) applying, (4) analyzing, (5) evaluating and (6) creating.

2010 Mathematics Subject Classification: 97C30, 97H20.
Keywords: field dependent, prospective teacher, mathematical problem solving, taxonomy of reflective thinking.

CT-05. The implementation of open inquiry approach to improve students' learning activities, response, and mathematical creative thinking skills

Kadir*, Lucyana, Gusni Satriawati
Department of Mathematics Education, UIN Syarif Hidayatullah Jakarta
kadir@uinjkt.ac.id, lucyana191412@gmail.com, gusnisatriawati@uinjkt.ac.id

The purpose of the present study is to find out the implementation of open inquiry approach to improve students' learning activities, response, and mathematical creative thinking skills. This research was conducted in SMP Negeri 1 Depok in academic year 2014/2015. The method used in this study is the Classroom Action Research, which consists of four stages research procedures were planning, action, observation, and reflection. Data collections by observation sheet activities, daily student journals, interview, and test. The result of the research revealed that the implementation of open inquiry approach can enhance students' mathematical creative thinking skills, this is prove by the increase in the average score from 73.68 to 78,00 in the first cycle to the second cycle. Indicators of mathematical creative thinking skills are fluency, flexibility, and originality. In additional, the results also showed that in general students' response positively and learning activities during the application of open inquiry approach classified in the category of "good". The conclusion of the research was the implementation of open inquiry approach can enhance mathematics learning activities, giving a positive response towards mathematics and to improve student' creative thinking skills.

2010 Mathematics Subject Classification: 97D50, 97C70, 97C30.
Keywords: open inquiry approach, learning activities, response, creative thinking skills.

CT-06. The relationship between math anxiety and students, attitudes, gender, personality types, and study habits at a case university in Jordan

Linda Smail
Zayed University
linda.smail@zu.ac.ae

Mathematics is the foundation of all sciences, but most students have problems learning mathematics. Although students' success in life is related to their success in learning, many would not take a math course if they did not have to do so to satisfy their university's core requirements. Although multiple reasons exist for students' poor performance in mathematics, one prevalent variable worth considering is personality type. This work seeks to uncover how students learn and study math and also prepare for exams and tests. We use Bayesian networks to link those different variables and detect possible relationships among these variables. The data used in this paper were derived from an accessible population of 468 students during the spring of 2009 at a U.S. institution in Jordan. Because little or no research has been performed in the area of math study and personality types, we undertook this study to add to this area of knowledge. This study reveals that math anxiety is not related to gender among this group of university students. Rather, math anxiety is related to personality types and study habits.

2010 Mathematics Subject Classification: 97A02, 62F15, 62C10.
Keywords: Bayesian networks, mathematics anxiety, MBTI, personality types.

CT-07. The changing scenario of mathematics formative assessment in the era of globalization (a Philippine university's undergraduate experience)

Maria Linda C. Cabillan*, Joezel R. Ambrosio, Rhona Lyn R. Bautista
John Carlo P. Unson*, Glory Ann Julien C. Winnan
Saint Louis University, Baguio City, Philippines
marialindacabillan@yahoo.com, joezelramosambrosio@yahoo.com.ph
bautista_rhonalyn@yahoo.com, jc.unson94@gmail.com, gloryannjulienwinnan@yahoo.com

This descriptive qualitative research intends to investigate formative assessment as used in undergraduate mathematics education in a university. Specifically, this research determines the current scenario of formative assessment as it seeks to recognize the adaptation and usage of formative assessment. It seeks to identify the challenges and opportunities that mathematics educators face in the area of formative assessment as universities adapt to the demands of globalization. It seeks to describe the characteristics of the mathematics educators based on their extent of use of 21st century formative assessment strategies and tools. There were 38 respondents employed in this research and were grouped according to years of teaching undergraduate mathematics, less than 10 years and at least 10 years. The findings revealed that both groups are more inclined in traditional formative assessment, specially pen and paper and oral approaches. Lack of time, computers,

multimedia, and high speed internet are main reasons cited by the respondents as hindrances in adopting the 21st century formative assessment tools.

2010 Mathematics Subject Classification: 05C78, 97D60, 97B40.
Keywords: formative assessment, mathematics education, assessment, undergraduate mathematics.

CT-08. The role of research-based learning to enhance student's research and academic writing skills

Rully Charitas Indra Prahmana*[1], Yaya S. Kusumah[2], Darhim[2]
[1]Dept. of Math. Edu., Surya College of Education, Tangerang, Indonesia
[2]Dept. of Math. Edu., Indonesia University of Education, Bandung, Indonesia
rully.charitas@stkipsurya.ac.id, {yayaskusumah, darhim_55}@yahoo.com

This study aims to design and develop a learning trajectory on research in mathematics education using research-based learning to enhance research and academic writing skills for pre-service mathematics teachers. The method used is a design research with three stages, namely the preliminary design, teaching experiment, and retrospective analysis. The research subjects are pre-service mathematics teacher class of 2012 from one higher education institution in Tangerang-Indonesia. This study describes how the developed learning trajectory contributes to enhance students' skills in doing research and writing academic paper by describing lectures activities, students' activities and achievement within 8 months. Initial data analysis of 35 pre-service teachers' research and academic writing skills was conducted in nine stages and the learning trajectories on this topic was identified. The research subjects were divided into ten groups and research independently to produce ten scientific articles. The use of research-based learning in designing learning trajectory of research in mathematics education plays a very important role as a trigger to enhancing math department preservice teachers' research and academic writing skills. This was shown by the final product of this study, which is 10 students' research and 10 submitted articles in a journal with ISSN and is indexed by google scholar through Open Journal System (OJS). In addition, this study also provides an overview of factors behind the diversity of results obtained by students during the learning process.

2010 Mathematics Subject Classification: 97B10.
Keywords: design research, local instruction theory on research in mathematics education, research skill, academic writing skill.

CT-09. Teachers' approach in teaching derivative to high school students: giving tasks and assessments

Rita Desfitri
University of Bung Hatta
rdesfitri@bunghatta.ac.id

The aim of this study was to figure out how teachers'approach in teaching derivative. The focus of this study was to discuss about how teachers used tasks and assessments when teaching derivative to their high schools students. This study was conducted at several high schools in Padang City. The participants of this study were high schools teachers who were teaching derivative at grade eleven. Based on the classroom observations and interviews, many teachers tend to use text book tasks, but a few of them tried to give open ended tasks. Supporting documents from questionnaire also showed that teachers recognized the various kinds of tasks were needed to help students understanding derivative concept. One interesting fact was that either they used open-ended tasks or text book tasks, their designs were related to their assessment purposes.

2010 Mathematics Subject Classification: 97C30, 97C50, 97D40.
Keywords: derivative, open-ended task, assessment.

CT-10. On the Vietnamese mathematical book of Nguyen Huu Than

Alexei Volkov[1], Thi Le Doan[2], Duy Phuong Ta*[3]
[1]Center for General Edu. and Inst. of History, National Tsing-Hua University
[2]Hanoi National University of Education
[3]Hanoi Institute of Mathematics, Vietnam Academy of Science and Technology
{alexei.volkov, ledoan.hnue}@gmail.com, tdphuong@math.ac.vn

The purpose of this paper is to analyze the mathematical methods and educational approaches found in the mathematical treatise Ý trai toán pháp nhất đắc lục (A Record of What Ý Trai [= Nguyễn Hữu Thận] Understood Correctly in Methods of Computation), written in 1829 by the Vietnames mathematician and astronomer Nguyễn Hữu Thận (阮 有 慎, 1756-1831).
In the Introduction of the paper we will provide a brief description of the Vietnamese mathematical treatises from the 15th to the beginning of the 20th century.

2010 Mathematics Subject Classification: 01A55, 01A75, 97-03.
Keywords: history of mathematics, mathematics education, mathematical didactics, traditional Vietnamese mathematics, Nguyễn Hữu Thận.

CT-11. History of complex analysis

Luis Manuel Tovar
ESFM, Instituto Politecnico Nacional, Mexico
tovar@esfm.ipn.mx

Why the history of Complex Analysis represents one of the most difficult births in the history of mathematics? What were the main difficulties he had for his birth? Who were the parents of the development of this theory? What were the most important applications that helped this theory was recognized in the world of science?

2010 Mathematics Subject Classification: 01A05.
Keywords: complex numbers, complex functions, analytic functions, conformal mapping.

CT-12 Analysis of historical perspective in reinventing mathematics concept on Indonesian mathematics textbook

Rooselyna Ekawati, Shofan Fiangga
Universitas Negeri Surabaya
{rooselynaekawati, shofanfiangga}@unesa.ac.id

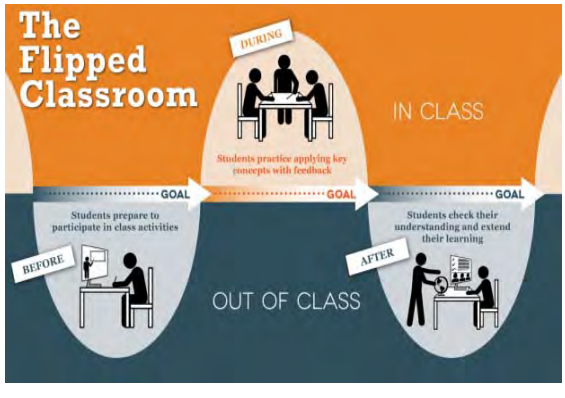
The use of historical perspective approach in mathematics classroom has become more popular research in mathematics education. One of perspective that can be used to support the pupils in reinventing mathematical concept is the History and Pedagogical in Mathematics (HPM). The way on how HPM could be used can be vary as direct historical information, historical inspired instruction, and mathematical awareness. One of possible way in implementing HPM is in the form historical snippets inside mathematics' textbook. Determining how the historical perspective could invite the mathematics concept reinvention is elicited in this paper. This Paper aimed at drawing the trend on how historical perspective in Indonesian Mathematics Textbook that help students to reinvent the mathematics concept. Some parts in Indonesian Mathematics textbook consider the essence of historical perspective in reinventing specific concept and other modified with such approach. The historical snippets appear with didactical approach that invites students' active involvement when others provide only factual data of historical concept as motivation.

2010 Mathematics Subject Classification: 97A30.
Keywords: textbook analysis, historical perspective, reinvention, Indonesia.

CT-13. Blending flipped classroom with CAS *maxima* in an introductory calculus course

Natanael Karjanto
Dept. of Mathematics, Natural Science Campus, Sungkyunkwan University
natanael@skku.edu

A number of positive features on implementing flipped classroom in an Introductory Calculus course by blending it with the use of technology is presented. A computer algebra system (CAS) of *Maxima* is adopted as an alternative choice of available open-source computer softwares. Flipped classroom is a nontraditional teaching approach where the teaching and learning activities are inverted or 'flipped' from the ones usually conducted in the traditional setting. The students must thus prepare and review the material before they come into the classroom. The purpose of flipped classroom is to improve the learning achievement, to engage students to become active learners and to stimulate the students' enjoyment and satisfaction in studying Calculus. During the pre-class time, the students are assigned to watch short video lectures, which have the duration length of five to ten minutes, on the materials relevant to the topic of that particular week. The video recordings are available online and are accessible via *YouTube*, where the corresponding video links are distributed through *icampus*, an internal platform of teaching and learning management system. In-class sessions are dedicated to inquiry, problem-solving, application, use of technology, assessment and feedback. *Maxima* is utilized not only for checking computational results done by pen and paper, but also for sketching functions and graphs with accuracy and with aesthetically pleasing figures. After implementing the flipped classroom, an anecdotal evidence suggests that the students learning achievement has been improved and the overall students' satisfaction is very positive.



2010 Mathematics Subject Classification: 97D40, 97C70, 97U70, 97U80, 00A35.
Keywords: flipped classroom, computer algebra system, *Maxima*, introductory calculus.

CT-14. Development of mathematics assistantship materials on fractions for primary teachers in the implementation of curriculum 2013

Siti Khabibah*, Siti M. Amin, Agung Lukito
Department of Mathematics, Universitas Negeri Surabaya (Unesa), Indonesia
{khabibah_khabibah, amin3105}@yahoo.com, gung_lukito@yahoo.co.id

The government, in this case the Ministry of Education and Culture, plans to introduce Curriculum 2013 gradually. Enforcement will begin in the 2013/2014 school year for grades 1 and 4 of Elementary School (SD), grade 7 of Lower Secondary School (SMP), as well as the grade 10 of Upper Secondary School (SMA) and Vocational Secondary School (SMK). For the academic year 2014/2015 it includes grades 2, 5, 8, and 11. Many institutes of teacher training (LPTK) will assist the implementation of the curriculum. To support the program it needs some assistantship materials for the primary teachers. At present the materials for them are not available. Thus it is necessary to develop assistantship materials on Fraction for them in order for supporting the curriculum implementation. The development of assistantship materials in this study will include: 1) Lesson Plan (SAP), which contains steps to be done by assistant while doing advocacy for the materials being selected, 2) Resource Book, contains a theory that can be used by teachers to carry out meaningful learning for students in accordance with the curriculum requirements, and 3) examples of instructional media that can be used by teachers in implementing the teaching and learning in line with the curriculum. Development phases follow the model proposed by Plomp (1999). The phases of the development model include: 1) analysis of the problem, 2) design, 3) realization, 4) implementation and 5) evaluation. The development products must meet three criteria for quality materials; that is, valid, practical, and effective. The materials are said to be valid if the experts consider them in the category of good or excellent. They are practical if the assistant states that the materials are usable in assisting the teachers in training and that all activities in SAP are successfully implemented. The materials developed is said to be effective if: a) the teachers being accompanied appreciate the assistantships, and b) the desired learning for the teacher assistantships occurs. The analysis results in that the instructional materials being developed for the assistance are: (1)valid; the experts gave a score of 3.4; (2) practical; the experts consider the materials usable theoretically and based on the results of the trial all the steps in SAP are performed well; and (3) effective; more than 75% of the participants gave a positive response and the participating teachers are able to develop lessons that correspond to the curriculum 2013.

2010 Mathematics Subject Classification: 97C70, 97A30.
Keywords: development, assistantship materials, fraction, curriculum 2013, quality materials.

CT-15 Facebook: playing significant role in mathematics teaching learning process

Rodulfo T. Aunzo, Jr. Ed.D
Dept. of Math., School of Arts and Sciences, University of San Carlos, Philippines
dolph.fu@gmail.com

Facebook has profoundly penetrated in the educational arena. There were various initiatives done by educators on the utilization of Facebook in the teaching-learning process. In this note, this paper focused various Mathematics teaching-learning process where Facebook plays significant role. There were three phases of this research study. The first phase was the deployment of the online quiz bee in the Facebook group as an avenue to heighten mathematics learning process. The second phase was the utilization of Facebook as a tool on flipped classroom where students learned mathematical concepts though cooperative learning way. And the last, Facebook was utilized as an avenue for online poster presentation where students presented their research outputs, from which online audience and researcher themselves interacted on the outputs of the research studies. This study showed further analysis on the students' perception on the utilization of Facebook in mathematics teaching-learning process.

2010 Mathematics Subject Classification: 97C70.
Keywords: facebook, mathematics, teaching-learning process, cooperative learning, flipped-classroom, poster presentation, quiz bee.

CT-16. Examining learning obstacle of students college from Papua-Indonesia

Sulistiawati*, Arumella Surgandini
Surya College of Education (STKIP Surya)
{sulistiawati, arumella.surgandini}@stkipsurya.ac.id

This research was motivated by the condition of many college students come from Papua-Indonesia having a lack of capability to understand Linear Algebra course. In the other side, this understanding is a main requirement to master the learning material. One of its causes is that they have learning obstacles. Both lack of understanding capability and learning obstacle strongly imply the inferior feeling among of the students. Subjects of this research are 30 students Linear Algebra course in academic year 2016/2017 term one who enrolled in academic year 2015/2016 and 2014/2015 of Surya College of Education (STKIP Surya). Prior to the course, we identify some problems related to learning obstacles to give appropriate treatment which is being conducted in second term of academic year 2015/2016. Methodology of this research is qualitative approach in which researcher acts as the key instrument. Data are collected by test, questionnaire, and interview which will be analyzed by descriptive qualitative analysis. The expected result of this research is the learning obstacle is epistemological obstacle including

ontogenical origin, didactical origin, and epistemological origin. Furthermore, the self confidence among the students are increasing during the course.

2010 Mathematics Subject Classification: 97A30.
Keywords: learning obstacle, epistemological obstacle, self-confidence, Papuan student.

Poster Sessions

P-01. Attitude toward mathematics among the students at Nazarbayev University foundation year programme

Akbota Mukhamediyeva*[1], Natanael Karjanto[2], Aknur Kozhagapar[1]
[1]Dept. of Math., School of Science and Technology, Nazarbayev University
[2]Dept. of Math., Sungkyunkwan University, South Korea
amukhamediyeva@nu.edu.kz, natanael@skku.edu, aknur.kozhagapar@nu.edu.kz

The attitude toward mathematics among the students enrolled in the Foundation Year Programme at Nazarbayev University is investigated in this paper. The study is conducted quantitatively and an inventory developed by Martha Tapia and George Marsh is adopted and utilized in our research. This inventory consists of 40 statements for which the students must choose one of the five-point Likert scale. The questionnaire also collects the respondents' data, which include gender, study programme emphasis and their final grade in mathematics during high school. A number of collected valid data is 108 students with 55 males and 53 females. Among them, 73 students are specialized in Mathematical–Physics, 22 students in Chemistry–Biology, and the other 13 students in Economics–International Relations. In general, these Foundation students have a positive attitude toward mathematics, as indicated by the attitude score mean of 3.999/5.00 with its standard deviation of 0.531/5.00. Further analysis confirms the hypothesis of a positive correlation between high achievement in mathematics and a favourable attitude toward mathematics. The medium effect size correlation value is $r = 0.300$ and it is extremely significant (p-value $= 0.0008 < 0.001$). This is due to the fact that the majority of the students are high achievers in mathematics during their secondary school phase, with an exceptionally high average of mathematics score of 4.935/5.00. It is also discovered that there is no significance difference between male and female students when it comes to the attitude toward mathematics ($t = 0.608$, p-value $= 0.2489 > 0.05$). On the other hand, from ANOVA analysis it is obtained that although there are no significance differences between Chemistry–Biology and Economics–International Relation students, as well as between Chemistry–Biology and Mathematical–Physics students, there is a very significant difference ($F(2, 105) = 5.6848$, p-value $= 0.0045 < 0.01$), however, and somewhat surprising, between Economics–International Relation and Mathematical–Physics students in terms their attitude toward mathematics.

2010 Mathematics Subject Classification: 97C40, 62P15, 91E45.

Keywords: attitude toward mathematics, academic achievement, study programme emphasis, gender difference.

P-02. Affect of interactive media and manipulatives on improving mathematical abilities of 5th grades students

Prih Hartanti[1], Yurniwati*[2]
[1]SDIT RPI Jakarta, Indonesia, [2]Jakarta State University, Indonesia
prih_hartanti@gmail.com, yurniwati@unj.ac.id

This research aims to know the effect between interactive media and learning tools towards 5th Grade students mathematical abilities. This research was conducted in Cengkareng West Jakarta. The data collected by tests and analyzed using analysis of variance (ANOVA). The results showed that: (1) students learned using interactive media have mathematical abilities better than students learned using manipulatives; (2) there is interaction between interactive media and self regulated learning to mathematical abilities; (3) students who have higherself regulated learning, get mathematical abilities score better if they learned by interactive media; (4) students who have lower self regulated learning, get mathematical abilities score better if they learned by manipulatives.

2010 Mathematics Subject Classification: 97U50, 97U60, 97E99.
Keywords: interactive media, manipulatives, mathematical abilities.

P-03. Reflective thinking in solving algebra problem: a case study of reflective-prospective teacher

Agustan*[1], Dwi Juniati[2], Tatag Yuli Eko Siswono[2]
[1]Universitas Muhammadiyah Makassar, Indonesia
[2]Department of Mathematics, Universitas Negeri Surabaya, Indonesia
agus.sahabat@gmail.com, dwi_juniati@yahoo.com, tatagsiswono@unesa.ac.id

Nowadays, reflective thinking is one of the important things which become a concern in learning mathematics, especially in solving mathematical problem. The purpose of this research paper is to describe how reflective thinking is used in solving algebra problem. The subject of this research is a student who has reflective cognitive style enrolled in Mathematics Education, Faculty of Teacher Training and Education (FKIP), Universitas Muhammadiyah Makassar, Indonesia. This research is a descriptive explorative study with using qualitative approach. Qualitative approach is chosen to describe in depth related to reflective thinking of prospective teacher in solving algebra problem that can be seen when subject solve algebra problem and semi-structured interviews are administrated to the subject. During the interviews, reflective thinking of subject was examined . There are four main categories to analyse the data related to reflective thinking prospective teacher of in solving algebra problem: (1) formulation and synthesis of experience, (2) orderliness of experience, (3) evaluating the experience and (4) testing the

selected solution based on the experience.The results of this study showed that the reflective-prospective teacher used interesting types and various ways of reflecting thinking when solve the problems.

2010 Mathematics Subject Classification: 97C30, 97H20.
Keywords: reflective thinking, prospective teacher, algebra problem.

P-04. Teaching mathematics to K-12 students using artifacts from Museo De La Salle

Ma. Theresa Christine C. Valdez*, Edwin S. Bunag, Lea D. Maderal
De La Salle University-Dasmarinas, Philippines
{mcvaldez, esbunag, ldmaderal}@dlsud.edu.ph

The artifacts found in Museo De La Salle were explored to identify whether these could serve as manipulatives for teaching Mathematical concepts to K-12 students particularly from Grade 7 to Grade 10. A survey and key informant interviews were conducted among seven (7) experienced Math teachers in order to explore the mathematical concepts that are observable in the 100 randomly selected artifacts. The teachers were also queried on how these Mathematical concepts can be learned and explored by the students. The study found that Geometry, Patterns and Algebra and Measurement were the main concepts that can be learned from these artifacts. Results further revealed that these concepts can be learned through visual approach, classification, measurement and as concrete exemplars for real-life situational problems. Insights from these results were drawn to develop activities in teaching mathematics to K-12 students. The study also emphasizes that museums are potential resources for the teaching and learning of Mathematics among K-12 students contributing to promote awareness, preservation, and appreciation of the arts and culture.

2010 Mathematics Subject Classification: 97A30.
Keywords: artifacts, K-12 students, manipulatives, mathematics, Museo De La Salle, teaching, education, museum.

P-05. Probabilistic thinking of elementary school students in solving probability task using experiments and non experiments

Dwi Ivayana Sari*[1], I Ketut Budayasa[2], Dwi Juniati[3]
[1]STKIP PGRI Bangkalan, Indonesia
[2]Postgraduate Program, Universitas Negeri Surabaya, Indonesia
[3]Department of Mathematics, Universitas Negeri Surabaya, Indonesia
dwiivayanasari@gmail.com, {ketutbudayasa, dwi_juniati}@yahoo.com

Mathematics in the Primary Curriculum is very important. Mathematics introduces children to concepts, skills and thinking strategies that are essential in everyday life. Following recommendations for early introduction of probability concepts

in school curricula and for students to exhibit probabilistic thinking, we tried to explore the probabilistic thinking of elementary school student in solving probability tasks. The our concern aspects of probabilistic thinking are responses, strategies and representations of subjects. Two different types of probability tasks is given to subjects, one is a standard probabilistic problem and the second type is the problems that facilitated students to solve the problems with doing some experiments. The subjects of this study were two students of fifth grade, one boy and one girl. The time triangulation of data is used to have credible data. The data was analysed, categorized, reduced, interpreted to make a conclusion. The result showed that in probability tasks non experiment, two subject could determine all possible outcomes in one-dimensional problems but failed for two-dimensional problems. they failed to determine which event was most likely to occur. they thought all events have the same probability to occur. However,in probability tasks by using experiment, they gave statistical response to determine all possible outcomes in one and two-dimensional by using odometer strategy. they could determine which of an event was most likely to occur by using incomplete denumerator strategy. they gave partial statistical response to determine which probability situation was more likely to generate the target event in a random draw. The case of reasoning, the boy gave logic reasoning and the girl gave subjective reasoning. The results of this study indicate that probability can be learnt by elementary students using experiments activities.

2010 Mathematics Subject Classification: 97C30, 97K50.
Keywords: elementary school students, probabilistic thinking, experiments.

P-06. Metacognitive profile of a female prospective teacher with cognitive field independent style in solving limit problem

Pathuddin*, I Ketut Budayasa, Agung Lukito
Postgraduate Program Surabaya State University Surabaya Indonesia
{pathuddin, ketutbudayasa}@yahoo.com, gung_lukito@yahoo.co.id

This study aims at describing the metacognitive profile of a female mathematics teacher student with cognitive field independent style in solving limit problem. The main data was collected through the student written works and in-depth interviews. From the qualitative data analysis we found that during the problem solving process this subject has shown the metacognitive skills including planning, monitoring, and evaluating as well as the metacognitive knowledge that is, either in the form of declarative knowledge, procedural knowledge, and conditional knowledge. These metacognitive activities emerged in all the phases of understanding the problem, devising a plan, carrying out the plan, and looking back.

2010 Mathematics Subject Classification: 97M20.
Keywords: metacognitive profile, female prospective teacher, cognitive field independent style, solving limit problem.

P-07. Adaptive reasoning and strategic competence in solving mathematical problem: a case study of female-field independent (F1) student

Andi Syukriani*[1], Dwi Juniati[2], Tatag Yuli Eko Siswono[2]
[1]STKIP-Pembangunan Indonesia Makassar, Indonesia
[2]Department of Mathematics, Universitas Negeri Surabaya, Indonesia
asyukriani@yahoo.co.id, dwi_juniati@yahoo.com, tatagsiswono@unesa.ac.id

Adaptive reasoning and strategic competence are two important components that can be assembled into a logical sequence in solving mathematical problem that both of them reflected a mathematical proficiency. This paper describes the adaptive reasoning and strategic competence in solving contextual mathematical problem involved settlement through some mathematical concepts. Researcher investigated aspects of adaptive reasoning and strategic competence student. The concern of adaptive reasoning aspects are explaining, justifying, reflecting ideas about relationships among concepts and problem situation. The aspect of strategic competence are how student develop some strategies for formulating, representing, and solving problem situation. Cognitive styles and gender are assumed to make an impact on mental activity student in solving mathematical problems involving adaptive reasoning and strategic competence. The interviews carried out to a eleventh-grade female high school student and have cognitive style Field Independent (FI). The subject make a relation between mathematical concepts and mathematical problem situations encountered. The subject formulating the problem situation by reading the problem, imagine the problem, and create illustration images by trial and error regardless of the size. The subject represented the problem situation by using illustration images and formula of the concept and solving them completely.

2010 Mathematics Subject Classification: 97C30,97C10.
Keywords: adaptive reasoning, strategic competence, field independent.

P-08. Prospective teachers conception about limit function

Usman[1], Dwi Juniati[2], Tatag Yuli Eko Siswono[2]
[1]Syiah Kuala University, [2]Surabaya State University
usmanagani74@gmail.com, dwi_juniati@yahoo.com, tatagyes@gmail.com

Limit function is a basic concept for the study of other concepts, such as continuous functions, derivative functions, and integral in mathematical analysis. Student teachers need to have a good conception of the limit functions. This study aimed to describe mathematics student teachers' conception about the limit function. This study focuses on the conception as the understanding and mental image conception. The research instruments were test on conception and interview related to materials of limit function. Data collected were analyzed through descriptive qualitative in nature. The results showed that students' conceptions about the limit function as an understanding wereable to interpret the symbols into graph,

said summing limit function, and the symbols meaning in the definition of limit function. While the mental image was stated limit function definition into words, table, and symbols.

2010 Mathematics Subject Classification: 60F17.
Keywords: conceptions, understanding, mental image, limit function.

P-09. Straight line equation scheme of student in grade 8 Christian Junior High School Salatiga

Herlina*, Kriswandani*
Satya Wacana Christian University
herlina.panggabean@rocketmai.com, kriswandani@staff.uksw.edu

Scheme is a term put forward by psychologist Jean Piaget. Scheme refers to cognitive structures that first appear during childhood and help children organize knowledge. Every student have different scheme because they have different ways to construct their knowledge. Based on that definition so the purpose of this research is a descriptive qualitative study aimed to determine straight line equation scheme of student in grade 8 Christian Junior High School Salatiga. The subjects of this research taken by purposive sampling and they are seven students consist of 3 female students and 4 male students. Data collection techniques in this study using observation, clinical interview and documentation. Data analysis techniques of Miles and Hubberman namely data reduction, the data display, and conclusion drawing. The results of the research were thirteen straight line equation schemes. They are 1) point cut of the x-axis and y-axis scheme; 2) point cut the apse and ordinate scheme as reference ; 3) any two points scheme; 4) over any two points scheme; 5) horizontal lines divided by vertical lines scheme; 6) direct division scheme; 7) difference between y and x points scheme; 8) division coefficient of y scheme; 9) moving segments x variables and constants to right segment scheme; 10) division coefficient y positive negative scheme; 11) moving segments all variables and constants to the right or the left segment scheme; 12) substitute constants into the equation; and 13) substitution repeated point y into equation.

2010 Mathematics Subject Classification: 14A15.
Keywords: scheme.

P-10. Student metacognition in solving open-ended problems

Zainnur Wijayanto
UST, Indonesia
zannuwijaya@gmail.com

The purpose of this research is to describe the process of student Metacognition in solving open-ended problems based on steps Polya. This type of research is exploratory qualitative research. Researchers study and unravel the process of student Metacognition in solving math problems based on steps Polya. The disclosure

process of Metacognition is carried out at each stage of problem solving, that is the stage of understanding the problem, the stage of problem-solving plan, the stage of carrying out problem-solving plans and stages of doing the evaluation of the results of the implementation of the plan of solving the problem. Furthermore using interview method will be revealed about the activity of the students' Metacognition in solving open-ended problems. The results showed students with high ability to perform activities at each stage of metacognition in open problem solving by step Polya. Students who are not capable of doing a good metacognition process in the last two stages by-step open problem solving Polya, they just do metacognition on stage to understand theproblem and devise a plan. Less capable students don't do process good Metacognition on the last three stages of the problem solving steps based Polya, they just seem to do at the level of understanding of the problem of Metacognition.

2010 Mathematics Subject Classification: 68T20.
Keywords: metacognition, problem solving, open problems.

P-11. Characteristics fragmentation of structure students thinking in solving mathematical problems

Kadek Adi Wibawa*[1], Toto Nusantara[2], Subanji[2], I Nengah Parta[2]
[1]University Mahasaraswati of Denpasar, Indonesia
[2]Malang State of University, Indonesia
adi_math@yahoo.co.id, toto.nusantara.fmipa@um.ac.id, subanjimat@yahoo.co.id
nengahparta@yahoo.com

Learning that is meaningless without trained on an ongoing basis with the problems of solving, not only make the students do not think. But causing conseptual fragmentations in the brain of the student. Conceptual fragmentation is a condition where the concepts've learned that students are not well connected, located far away without connections, randomized-random without meaning, or there may be a hole understanding and pseudo understanding because rarely or never used (erased). In this paper will be presented how the fragmentation characteristics of the structure of the student's thinking in solving mathematical problems. This study was conducted at Malang State of University that uses a mixed method approach that combines quantitative approach to the processing of data about the types of fragmentation that occurs and qualitative approach to the teaching process of the fragmentation of the structures of student thinking in solving a given problem. The instrument used was a matter of the type of problem-solving that requires subjects to associate the concept definite integral as area, representation of the function in geometry, definite integral as sum of Reiman, and area always in real positif. This study gives an overview of student thinking related to the fragmentation of structures that make it difficult, and errors in solving the problem. With this result, the needed depth study how to handle it, and more about how to design learning that can minimize the fragmentation of the structure of thinking.

2010 Mathematics Subject Classification: 68T20.
Keywords: problem solving, fragmentation structure thinking, hole's understanding, pseudo understanding.

P-12. The mathematical profiency of elementary student winning the national olympiad medals in science in making equation

Syarifatul Maf'ulah*[1], Dwi Juniati[2], Tatag Yuli Eko Siswono[2]
[1]STKIP PGRI Jombang, Indonesia, [2]Universitas Negeri Surabaya, Indonesia
syarifatul.m@gmail.com, dwi_juniati@yahoo.com, tatagsiswono@unesa.ac.id

Abstract. The importance of a skill in making equation was highly considered by the researcher while giving arithmetical tasks "$\ldots - 79 = 412$" to 86 fifth graders. They were asked to fill the blank. It was found that there were 85 pupils answered the tasks incorrectly. If the abilities in making equation are well-applied, then they would be able to determine what they should fill in the blank, because the pupils will probably think that the equivalent equation could be made is "$\cdots = 412 + 79$" Thus, an ability of making equation should be considered since early stage. On the other hand, there is particular factor supporting pupils in solving the tasks which is mathematical proficiency, including (1) conceptual understanding; (2) procedural fluency; (3) strategic competence; (4) adaptive reasoning; and (5) productive disposition. Then, this mathematical proficiency will optimize the ability in constructing equation. Therefore this study aims to describe mathematical proficiency of elementary student in making equation. The subject of this study is the student winning the National Olympiad medals in science, as he is the national assets that should be well-preserved, concerned, and used as role-models for his peers. This study is qualitative by using test and interview as the methods. The test conducted contains an initial equation, "$18 + d = 12$". The subject is then asked to make as many as equations equivalent to the initial one. The result is analysed based on particular indicator of mathematical proficiency in making equation. The result shows that; for conceptual understanding, the subject has made 37 equations equivalent to the initial one with different concepts such as square, square roots, and fraction. For procedural fluency and strategic competence, he has made particular equations as many as 12 strategies. One of interesting strategies is by squaring the both sides of the initial equation although the square roots have not been taught in elementary grades. For adaptive reasoning, he argues that there is a relationship between an initial equation and the new one because both equations have similar d value. And for productive disposition, he has fluently made such 37 new equations by various ways or strategies through well-procedures in about 30 minutes. This study concludes that the mathematical proficiency of elementary grade students winning the National Olympiad medals of science has been well-applied in making equation.

2010 Mathematics Subject Classification: 97A30.
Keywords: mathematical proficiency, olympiad medal, making equation.

P-13. The effect of mathematical investigation on students' intention to conduct mathematical research

Jonny Bernas Pornel
University of the Philippines Visayas, Philippines
jbpornel@up.edu.ph

Engaging in mathematical research is important. It enhances the researcher's mathematical prowess and understanding. Mathematical research is about productivity; it is about production or discovering of new knowledge. Engaging in mathematical research is an important activity of mathematicians. Students who will acquire the habit of doing mathematical research would be indeed valuable in the modern society. It is, thus, greatly beneficial to encourage students to conduct mathematical research. Behavior intention had been found to be a better predictor of behavior than attitude. Thus, this study aimed to determine the students' intention to conduct mathematical research after experiencing several sessions of mathematical investigations. To measure the students' mathematical research intention, the students were given the Mathematical Research Intention Scale (MaRIS) which was developed by the researcher. The scale measured the students' perceived subjective norm, perceived behavioral control and attitude towards doing mathematical research. The internal consistency of the attitudinaire of MaRIS is $\alpha = .849$. The results showed that indeed students' intention to conduct mathematical research significantly improved after experiencing several sessions of mathematical investigations. Students' reaction towards the activities will also be reported. The study will be beneficial for those who want to improve students' mathematical creativity.

2010 Mathematics Subject Classification: 97D40.
Keywords: mathematical investigation, mathematical research intention, attitude.

P-14. Teacher's pedagogical content knowledge in mathematics subject on limit of function

Ma'rufi*[1], I Ketut Budayasa*[2], Dwi Juniati[2]
[1]Universitas Cokroaminoto Palopo, [2]Universitas Negeri Surabaya, Indonesia
marufi.ilyas@gmail.com, {ketutbudayasa, dwi_juniati}@yahoo.com

Pedagogical Content Knowledge (PCK) is one of important kinds of knowledge in teaching in order the materials taught can be easily comprehended by the students. This study is aimed at investigating the senior high school teachers' PCK in teaching mathematics on the materials of limit of function based on their teaching experience. Two mathematics teachers with different teaching experience, one novice teacher and one experienced teacher, were the subjects of this study. The data were collected through interview and observation. PCK is defined as a kind of knowledge and the teacher's comprehension about the materials taught and the way of teaching a particular material in order to make the students comprehend

the materials. The purpose of this article is to describe the novice teacher's PCK on three components of PCK, namely knowledge of subject-matter, knowledge of pedagogy, and knowledge of students. Knowledge of subject-matter is the teacher's comprehension on conceptual and procedural knowledge. Knowledge of pedagogy is the teacher's competence in organizing materials and applying teaching strategies. Knowledge of students refers to the teacher's knowledge about the students' conception and misconception. The interesting things in this study are the novice teacher has adequate knowledge about limit of function, but knowledge of pedagogy and knowledge of students are still less in particular aspects.

2010 Mathematics Subject Classification: 97C70.
Keywords: pedagogical content knowledge, knowledge of subject-matter, knowledge of pedagogy, knowledge of students, limit of function, novice teacher.

P-15. GView a geometrical teaching aids development based on augmented reality

Iqbal Wahyu Septiyadi*, Ahmad Zulfakar Rahmadi, Alfa Satyaputra
STKIP Surya, Indonesia
{iqbal.wahyu, ahmad.zulfakar}@students.stkipsurya.ac.id, alfa.satyaputra@stkipsurya.ac.id

Geometry is one of the lesson that studied in school. Geometry is one of the abstract material which needs media to help students understand in a concrete way. This research focuses on developing mathematics teaching aids by applying augmented reality to teach geometry. This research is done for students in grade 8th at SMP GENIUS. It would visualize a 3D geometrical object by using android application. Augmented reality has an important role on making a virtual object to be a real one. GView has been designed as a geometrical teaching aid which giving real experience in learning a virtual object. As a teaching aids GView is designed to build an interactive learning process for students. GView needs to be operated by using marker to make a pattern which then to be uploaded in website named vuforia. GView has been developed through particular steps: making a 3D object, making marker, uploading marker to the website, synchronizing object, building its application, installing its application to smartphone. Objects GView of 2D and 3D shapes are designed by using blender3D program. GView has shown its function to display a virtual 3D object from 10cm as its optimum distance. GView works best in an optimal angle based on light intensity. As the result, Gview is essentially needed to explain the characteristics, volume, and the area of 3D shapes and Gview has gained students attention to be more active during learning process.

2010 Mathematics Subject Classification: 97G60, 97Q30, 97U99.
Keywords: GView, geometry, augmented reality.

P-16. Types of warrant in mathematical argumentations of prospective-teacher students

Lia Budi Tristanti*[1], Akbar Sutawidjaja[2], Abdur Rahman As'ari[2], Makbul Muksar[2]
[1]STKIP PGRI Jombang, Indonesia, [2]Malang State University, Indonesia
btlia@rocketmail.com, akbar.sutawidjaja@gmail.com, {ar.asari, mmuksar}@yahoo.com

Abstract. This paper discusses types of warrant in mathematical argumentations stated by prospective-teacher students. Dealing with mathematics task, a problem solver needs argumentations to determine, yield, and bolster reasonable solution. Mathematical argumentations stated by students can be analyzed using Toulmin scheme that consists of data, claim, warrant, backing, rebuttal, and qualifier. This study focused on a warrant because warrant is one determinant of the quality of an argumentation. This study aims to describe types of warrant in mathematical argumentations. This study applied qualitative approach by collecting some data from written result, think aloud and interview. The subjects of this study are asked to investigate the truth of mathematical statements. Researcher choose prospective-teacher of Mathematics Education Study as a subject, because the subject of the study will be a teacher of mathematics, who will influence in the developed process of thinking students in the mathematical arguments. The result shows that there are three types of warrant in a mathematical argumentation stated by the students, that is structural intuitive, inductive and deductive. Both inductive and structural-intuitive warrants are non-deductive warrant. Non-deductive warrant is used to reduce uncertainty of the conclusion. Besides, the subjects using deductive warrant is used to remove uncertainty of the conclusion.

2010 Mathematics Subject Classification: 97A30.
Keywords: warrant, mathematical argumentation, prospective teacher.

P-17. Strategy of proportional reasoning of junior high school students in mathematical problem

Marwia Tamrin Bakar*[1,2], Yuli Fitrianti[1,3]
[1]Indonesia University of Education, [2]Universitas Khairun, Indonesia
[3]Universitas Islam Negeri Raden Fatah, Indonesia
tmarwia@gmail.com, yfuin@yahoo.com

Ratio and proportional reasoning is as basic of knowledge in mathematics. This concept is not only used in mathematics such as enlargement, similarity of figure, and geometry but this concept also uses it in science. However, it has been long time that the students feel difficult to understand and use the concept of ratio and proportional reasoning in mathematic problem. This study investigated the method and strategies that were used by the students of junior high of Muslim in Ternate grade three to solve the mathematics problem that related to the ratio and proportional. In investigating the method and strategies were used by the students, the students were not only given task that related to the ratio and proportional

reasoning but there also were 9 students interviewed and the students were chosen based on the students' ability (high, middle, and low achiever). The analysis of method and strategies of the students in this study Piaget strategy qualification were used.

2010 Mathematics Subject Classification: 97A30.
Keywords: proportional reasoning, mathematic problem , ratio and proportional.

P-18. Revealing the fundamental ideas of algebra through exploration of history of algebraic thinking: a literature review

Yuli Fitrianti*[1,2], Marwia Tamrin Bakar[1,3]
[1]Indonesia University of Education
[2]Universitas Islam Negeri Raden Fatah, Indonesia, [3]Universitas Khairun, Indonesia
{yfuin, tmarwia}@yahoo.com

Some fundamental ideas of algebra are important to be revealed that can be the initial point to know, to understand, and to develop algebraic ideas for teaching in schools appropriately in contexts. The goal of this article is to expose some primal ideas of algebra originated along the history of algebraic thinking. The historical records show that the primal ideas of algebra initiated as the impact of solutions of some practical and non-practical problems existing in old civilization era. The essential problems observed and explored in old civilization era are about numbers and geometrical problems. The author of this article discusses three fundamental ideas of algebra by exploring historical records of algebraic thinking and breaks down the ideas using modern algebra.

2010 Mathematics Subject Classification: 97A30.
Keywords: algebraic ideas, algebra for schools, fundamental ideas of algebra, history of algebraic thinking.

P-19. Influence of learning subtraction based on critical point in Matematika GASING towards students achievement

Mika Meitriana Manurung*, Lukman Fakhmi, Nofrianti, Johannes Siregar
STKIP Surya, Indonesia
{mika.meitriana, lukman.fakhmi, nofrianti}@students.stkipsurya.ac.id
johannes.siregar@stkipsurya.ac.id

Based on some researches in mathematics education in Indonesia, we find that subtraction is basic operation which is hardest to be mastered besides the other. There are many methods to teach subtraction operation such as conventional way and other. Matematika GASING (GAmpang, aSyIk, menyenaNGkan) is how to learn mathematics easily, fun and enjoyable which was developed by Prof. Yohanes Surya from Surya Institute in Indonesia. In mathematics operations by using Matematika GASING there are some critical points that must be mastered. The critical points of subtraction are the concept of subtraction, subtraction under

10 and subtraction of 10 pairs. This research aims to find out the influence of the application of learning subtraction with conventional way and teaching based on Matematika GASING. The subject of this research is students of the first grade Elementary School in Tangerang. The method of this research is Quasi Experiment with Non-equivalent Control Group Design. The statistics obtained are analyzed using quantitative descriptive.

2010 Mathematics Subject Classification: 97-06, 97C40, 97D40.
Keywords: subtraction, Matematika GASING, critical point, quasi experiment.

P-20. Identification junior high school student's geometry skills based on Van Hiele's thinking level

Qurniawan Agung Putra*, Qopa Almaisurie, Ira Silviana Rahman
Nerru Pranuta Murnaka
STKIP Surya Tangerang, Indonesia
{qurniawan.edu, qopalmai25, irasilviana.rahman}@gmail.com, nerru.pranuta@stkipsurya.ac.id

Mostly people think that mathemathics is an abstract. However mathemathics concept is essentially needed in life. One of them is geometry that applied in many other branch of science such as medical, architecht, technological development, and many else. This information could become a benchmark, that geometry should have been understandable much more easily. In fact, geometry is difficult to understand by students as the students need to dig deeper into the concept of geometry itself. Comprehension of this idea ought to have been taught to primary school where each students has a different level of thinking. As per Van Hiele thinking levels, there are 5 levels of students understanding about geometry. Level 0 (visualization), level 1 (analysis), level 2 (informal deduction), level 3 (deduction), level 4 (rigor). The aim of this research is to identified and describe the students understanding about geometry based on Van Hiele thinking levels. This research is descriptive qualitative. The sample of this research's is one of the 8th grade in Tangerang, Indonesia. The data obtained in this research's shows that the thinking levels of students are different, which is in the range 0-3 while the level 4 is not owned by students as an object in this research. Thus, required implementing special learning method in geometry to increase the students understanding about geometry itself.

2010 Mathematics Subject Classification: 97A99, 97C30, 97G99.
Keywords: geometry, Van Hiele, student's thinking level.

P-21. Mathematics mobile learning application as supplement for senior high school students to learn trigonometry

Dani Kusuma*, Tri Nova Hasti Yunianta
Satya Wacana Christian University, Indonesia
202012058@student.uksw.edu, trinova.yunianta@staff.uksw.edu

The aim of this research is to develop mathematics mobile learning application as a tool to help senior high school students learn mathematics, especially in Trigonometry Material. Mobile learning is kind of unique learning tool because learners can access their learning materials, instructions, and questions related with their learning, whenever and wherever they want to learn. Mobile learning is designed by using Corel Draw X7 software. Then, researcher used MIT Inventor as online software to create this application that can be put in Android. This research utilizes ADDIE development phase such as analysis, design, development, implementation and evaluation. Students in grade X Social Class 3.2 in SMA Negeri 1 Salatiga as the subject. The instruments in this research include questionnaires about learning style, validation media sheets, pretest and post-test, practical sheets, and students' opinions sheets. Provided that the application is valid, effective and practical use in learning mathematics. The data was collected then it was analyzed in a qualitative and quantitative method. Mathematics mobile learning effective as a supplement in learning trigonometry because it can increase students' post-test result in amount of 0.71 or 71 percent by using n gain calculation rules. It belongs to high category. Students response also positive because this mobile learning as learning tool and supplement can help students learn trigonometry.

2010 Mathematics Subject Classification: 97A30.
Keywords: mathematics, mobile learning, supplement, trigonometry.

P-22. Investigation of impacting factors for learning achievement of mathematics students

Ferry Vincenttius Ferdinand*, Samuel Lukas
Universitas Pelita Harapan, Indonesia
{ferry.vincenttius, samuel.lukas}@uph.edu

Improving learning achievement is an activity that runs continuously carried out by any educational institution. It is necessary to focus on certain areas because of many things that affect learning achievement. Areas that need to be considered are the classroom environment and teacher-student interpersonal behavior. The purpose of this study is to analyze the relationship between learning achievement with classroom environment and teacher-student interpersonal behavior. Furthermore, relationships between the last two are examined. By using a sample of 160 X-university students majoring in mathematics, r Pearson correlation method is used to examine the relationship between the classroom environment

and teacher-student interpersonal behavior. Meanwhile, the relationship between learning achievement with classroom environment and teacher-student interpersonal behaviors are examined using Chi-Square method with contingency tables. The analysis is divided into two group where the division is based on the different characteristics of each courses, major courses and general courses. Based on the analysis and calculation, it was found that there are certain dimensions of the variables related to each other. First, the classroom environment has a relationship with learning achievement for both courses. Second, learning achievement related with teacher-student interpersonal behavior in the dimensions of leadership, understanding, and friendly/helping positively while negatively with the dissatisfied and strict dimensions. For the course majors, the uncertain and admonishing dimensions of the teacher-student interpersonal behavior is negatively associated with learning achievement, but not for general courses. Lastly, there are some dimensions in the teacher-student interpersonal behavior that are correlated to some dimensions of the classroom environment.

2010 Mathematics Subject Classification: 97A70, 97B40, 97C60, 97C70, 97D40, 97D60.
Keywords: classroom environment, teacher-student interpersonal behavior, learning achievement, QTI, CUCEI.

P-23. Linear equation system of two variablesscheme of student in grade X Senior High School of state 2 Salatiga

Bayu Setyo Nugroho, Kriswandani
Satya Wacana Christian University
bayusetyo11@gmail.com, kriswandani@staff.uksw.edu

Scheme is refers to cognitive structures that first appear and help student organize knowledge. This research is a qualitative descriptive research aimed to describe schemes for the linear equation system of two variables of student in grade X Senior High School of State 02 Salatiga. Identification of student think section's is very important to develop the knowledge of students. The subjects of this research are 5 students determined by purposive sampling. Data collection techniques in this study using observation, clinical interview, and documentation. Data analysis techniques of Miles and Hubberman namely data reduction, the data display, and conclusion drawing. The results of this research showed that there were nine linear equation system scheme of two variables used student, including elimination and substitution scheme, multiplying the two equations scheme, reduction of two equations scheme, addition of two equations scheme, simplified by dividing two sides scheme, multiplication into division scheme, moving sides different signs scheme, cross-product scheme, and division into multiplication scheme.

2010 Mathematics Subject Classification: 97A30.
Keywords: linear equation system of two variables.

P-24. The quantitative reasoning ability of mathematics pre-service teacher in the topic of statistical data analysis

Agustinus Sroyer
Cenderawasih University, Jayapura, Papua, Indonesia
sroyera@yahoo.co.id

One of the reasoning abilities in mathematics is quantitative reasoning. In this type of reasoning, one is required to use his or her quantitative ability to answer each question/problem he or she is posed with. Due to its importance, quantitative reasoning is always used as one of the instruments in selecting employees of an institution or company, or known as Academic Aptitude Test. In addition, questions in the forms of quantitative reasoning are often used in international level tests, such as IELTS. This research adopted descriptive-qualitative approach. The subjects consisted of 6 (six) final semester pre-service teachers in the Study Program of Mathematics Education for the academic year of 2014/2015, taken with the technique of purposive sampling. The instruments consisted of tests and non-test (interview). The tests were in the forms of questions on statistical data analysis, while the interview was conducted focusing on the answers previously given by the students. It is found that during an interview with subjects R3 and R6, the answers provided in the interview were the same as those in the written test with similar reasons, namely a lack of accuracy.

2010 Mathematics Subject Classification: 62-07.
Keywords: quantitative reasoning, statistical data analysis.

P-25. Minimizing student's fault in determining the design of experiment through inquiry-based learning

D. P. E. Nilakusmawati*, Made Susilawati
Department of Mathematics, Udayana University, Indonesia
{nilakusmawati, madesusilawati}@unud.ac.id

The purpose of this study were to describe the used of inquiry method in an effort to minimize students' fault in designing an experiment and to determine the effectiveness of the implementation of the inquiry method in minimizing students in designing experiments on subjects experimental design. This type of research is action research participants, with a model of action research design. The data source were students of the fifth semester who took a subject of experimental design at Mathematics Department, Faculty of Mathematics and Natural Sciences, Udayana University. Data was collected through tests, interviews, and observations. The hypothesis was tested by t-test. The result showed that the implementation of inquiry methods to minimize of students fault in designing experiments, analyzing experimental data, and interpret them in cycle 1 students can reduce fault by an average of 10.5%. While implementation in Cycle 2, students managed to reduce fault by an average of 8.78%. Based on t-test results can be concluded that the inquiry

method effectively used to minimize of students fault in designing experiments, analyzing experimental data, and interpreting them. The nature of the teaching materials on subject of Experimental Design that demand the ability of students to think in a systematic, logical, and critical in analyzing the data and interpret the test cases makes the implementation of this inquiry become the proper method. In addition, utilization learning tool, in this case the teaching materials and the students worksheet is one of the factors that makes this inquiry method effectively minimizes of students fault when designing experiments.

2010 Mathematics Subject Classification: 97U40.
Keywords: inquiry-based learning, experimental design, minimization student's fault, students worksheets.

P-26. Learning sum of series through a black dot for primary school

Sari Juliana*, Novi Purnama Sari, Lilis S. J. Manullang, Bobbi Rahman
STKIP Surya, Indonesia
{sariayi20, novinovipurnama, lilismanullang, rahmanbobbi}@gmail.com

Discussing sum of series in learning mathematics begin as one of the topic in high school level as it is based on mostly mathematics curriculum. Many kinds of abstract formula uses to determine a sum of series becomes a main reason to put the topic there in high school as they have reached an abstract stage of thinking. However, the main problem is extremely not in an abstract formula used so that primary students should not have learned the topic earlier but more to the learning method. Learning method has to be effective based on students level of thinking. It would help them to learn more even the higher level of topic. Then, an abstract concepts to learn some of series for primary students would not become a problem if effective learning method applied. A black dot has been designed to bring a concrete concept to learn sum of series as it is based on thinking level development of primary school students. It has no more reason to postponed this topic until high school level. In this article, a black dot is used to help fourth graders in SDN Cihuni II Tangerang. This research provides a description of how a black dot has helped students to understand sum of series earlier.

2010 Mathematics Subject Classification: 97C70, 97D40, 97I30.
Keywords: black dot, sum of series, primary school students.

P-27. Process of constructing proof by graduate student based on reflective abstraction

Syukma Netti*[1], Akbar Sutawidjaja[2], Subanji[2], Sri Mulyati[2], Sudirman[2]
[1]Bung Hatta University, Indonesia, [2]Malang State University, Indonesia
syukmaneti@bunghatta.ac.id, {akbar.sutawidjaja.fmipa, subanji.fmipa}@um.ac.id
{sri.mulyati.fmipa, sudirman.fmipa}@um.ac.id

In this paper we describe the process of constructing proof by students based on reflective abstraction from Piaget. Piaget (Dubinsky, 2002) introduced five types of

constructing in reflective abstraction they are interiorization, coordination, encapsulation, generalization and reversal. However, this study only used four types, except reversal constructing because it has nothing to do with material content. The purpose of this study is to describe the processes the student should get through with to solve proof task within context of composition of the injective function . The result of student's work were identified based on four types of constructing in reflective abstraction. Subjects of this study were five students of Malang State University, who had passed the subject analysis real. This study had obtained some processes the students got through with to construct proof. After observing the works of five subjects, only two subjects could construct the valid proof, while the three others failed. The processes of constructing proof were analyzed by comparing the ideal mental activities (based on problem structure) to student's thinking structure. Based on the result of analysis, it can be concluded that there are five process that the student might get through with to construct proof. They are ideally constructed proof, well-constructed proof, failure to construct proof in interiorization, failure to construct proof in coordination and failure to construct proof in encapsulation.

2010 Mathematics Subject Classification: 97A30.
Keywords: constructing proof, abstraction reflection, composition function.

P-28. Learning algebra in early mathematics education through magic box

Novi Purnama Sari, Lilis S. J. Manullang*, Sari Juliana, Bobbi Rahman
STKIP Surya, Indonesia
{novinovipurnama, lilismanullang, sariayi20, rahmanbobbi}@gmail.com

Algebraic concepts are mostly been postponed to be taught until the students reach certain level thinking like in high school level cause it is required well logical thinking development. Most researches have stated the difficulties faced by most students on learning algebra. In other words, understanding algebra is extremely hard unless an effective method applied during learning process. Applying an effective ways of learning algebra becoming a key point to help students' understanding no matter what level they are in. Then, algebra have importantly to be taught earlier. Learning algebra in early mathematics education is highly recommended as it is essentially needed to help students understand a strong role of algebra in life earlier. Here, we provide evidence that young students on primary school can learn early algebra by using magic box. Magic box has been designed in an unique way to attract students attention and help them to understand algebra easier. This study focused on qualitative research in which we investigate second graders students in SDN Cihuni II Tangerang on using magic box to learn early algebra. In this article we describe how magic box has successfully supporting students in understanding algebra in the early mathematics education.

2010 Mathematics Subject Classification: 97C70, 97H30, 97U60.
Keywords: algebra, magic box, early mathematics education.

P-29. LAPS (Logan Avenue Problem Solving)-heuristic model on increasing student's critical thinking skill

Ira Silviana Rahman*, Nerru Pranuta Murnaka
STKIP Surya, Indonesia
irasilviana.rahman@gmail.com, nerru.pranuta@stkipsurya.ac.id

Critical thinking skill is one of four kind of advanced thinking level model. It is importance for students to develop their logical and convicing mindset. One of learning model that expected can increase critical thinking skills is LAPS (Logan Avenue Problem Solving)- Heuristic by researcher. The purpose of this study is to investigate the effects of LAPS (Logan Avenue Problem Solving)- Heuristic on increasing student's academic knowledge and achievements based on critical thinking skills. This research is pre-experimental with one group pretest-posttest design. The hypothesis is evaluated by normality and homogeneity test. The sample is 8th grade students in one of junior high school Tangerang by purposive sampling technique. The result show that LAPS-Heuristic method can increase student's academic knowledge and achievements based on critical thinking skills. Moreover, there is a positive response in learning that use LAPS-Heuristic model. Based on the result and discussion of the research, there is several conclution. First, LAPS-Heuristic model can be used to develop critical thinking skill. Second, LAPS-Heuristic can develop student's mindset on mathemathics learning comprehension. Last, it make positive response on students in mathematics learning by use LAPS-Heuristic model.

2010 Mathematics Subject Classification: 97A99, 97C70, 97M99.
Keywords: LAPS-Heuristic, critical thinking skills, mathematics learning.

P-30. The influence of learning style toward student learning outcome about multiplication using Matematika Gasing

Nia Yuniarti, Asri Gita, Nerru Pranuta Murnaka
STKIP Surya, Indonesia
{nia.yuniarti, asri.gita}@students.stikpsurya.ac.id, nerru.pranuta@stkipsurya.ac.id

This research was conducted based on the student learning style differences in mathematics, especially in multiplication topic. This research is a pre-experimental design. The design that is used in this study is The One Group Pretest-Posttest Design. The purpose of this study is to find out the influence of student learning stlye that have type of visual, auditorial, and kinesthetic toward learning outcome in multiplication topic with Matematika Gasing. The population in this study is 5^{th} grade students in Cihuni I elementary school in Kelapa Dua Tangerang districts. The sampling technique had been used is purposive sampling and data collected by test and questionaire. The data findings were analyzed by using anova with significance level 5%. The expected results this research is there is positive influence

of student learning stlye that have type of visual, auditorial, and kinesthetic toward learning outcome in multiplication topic with Matematika Gasing.

2010 Mathematics Subject Classification: 97C20, 97C30, 97C50.
Keywords: learning style, student learning outcome, Matematika Gasing.

P-31. The principle of temple width technic and projection of matrix in the addition operation of sequence of square

Subaryanto[1], Choirul Huda[1], Rendy Wikrama Wardana[2], Riany O. Sungkawa[3]
[1]Mathematic Teachers Senior High School State 4 Muaro Jambi Indonesia
[2]Science Education Postgraduate school UPI Indonesia
[3]Enghlish Education Undergraduate School UPI Indonesia
{subaruela, chairul.huda1976, rendy86.upi}@gmail.com, rianyoktaviani@yahoo.com

Learning and discussing about operation of sequence, there is a term called sequence of square. In Mathematics, the sequence of square is used to simplify the calculation of value from a function. There are some representations of sequence of square; two of them are Taylor Series and Maclaurin Series. The different between the two of them lies in whether there is changes of x point in nin a function. The previous theory of addition in sequence of square is a little bit complex, so that the addition needs to be assessed to make it less complex.One way of the assessment is to use the principle of temple width technic and the projection of matrix. The goal of this research is to represent the principle of temple width technic and the projection of matrix as addition in sequence of square. For that purpose, the methodology used for this research is descriptive method.The result of this research shows that the technic and the projection can represent and explain the additionof sequence of square from square 1 to square z.Thus, giving a new knowledge in addition operation of sequence of square.

2010 Mathematics Subject Classification: 11B50.
Keywords: the principle of temple width, projection matrix, addition operation of sequence of operation.

P-32. Ethnomathematics in Sundanese cultural perspective

Atje Setiawan Abdullah
Department of Computer Science, Universitas Padjadjaran
atjesetiawan@gmail.com

In the culture of Sundanese people, many customs inherited from generation to gener- ation is maintained and used to communicate in daily life, one of which relates to the mathematical sciences. In Sundanese society still apply mathematical calculations on an informal basis in the form of figures of speech, which can be compared with formal calculations, such as mathematical calculations used to describe the unit of account, length, width, height, area, volume, time, and forecasting using a simple mathematical model. In the world of knowledge, known as

ethnomathematics, namely the study of the relationship between mathematics with culture, which is not written and practical use in everyday life. ethnomathematics also an instrument to understand the culture and understand the mathematics, as well as to appreciate the relationship between these two things. In this article, I will explain the habits associated with ethnomathematics or the role of mathematics in the life of the Sundanese people, which is still widely used in communication in everyday life, especially by the Sundanese people in the rural. Ethomathematics which will be discussed in this paper relates to when the tide, symbolic depiction of measuring instruments and symbolic force in Sundanese.

2010 Mathematics Subject Classification: 01A07.
Keywords: ethnomatematics, culture, Sundanese people.

P-33. The increase students' learning activities in elementary statistics course with cooperative learning

Yusri Wahyuni
University of Bung Hatta, Indonesia
yusriwahyuni85@yahoo.co.id

This research aims to increase student activity on elementary statistics course with cooperative learning. This study includes classroom action research, which consists of four stages : planning stage, implementation of the action, observation stage, and phase of reflection. The subject of this study is A class student mathematics education who take courses ini elementary statistics which amounted to 41 people. Instruments used in this study a student activiy observation sheet. The results of research in cycle 1 indicates that every indicator of students' learning activities do not meet the targets expected in research that 70 % of the total number of students has been carrying out research activity indicator. Then this study continues to cycle 2. The results of analysis of the second cycle increased student activity indicator of cycle 1, and any research activity indicator already meet the expected targets in research, that every indicator of activity in the research have been achieved up to 70 %. So that the treatment of the sample classes only up to the second cycle. Conclusions of this study, Increase students' learning activities at each meeting in each cycle. This proves that the cooperative learning, students are able to develop patterns of thought and want to try their own so that they are able to solve a problem.

2010 Mathematics Subject Classification: 97.
Keywords: increase, activity, cooperative learning.

P-34. Design and validation of teaching mathematics books based on ICT with CD tutorial for senior high school student grade X 1^{st} semester

Tika Septia*, Sofia Edriati
STKIP PGRI West Sumatera, Indonesia
{tikaseptia2589, sofiaedriati81}@gmail.com

Mathematics learning based on ICT is learning according to curriculum of 2013. In this case, required an integrated ICT teaching materials. Based on observations to some high schools in Padang, found that there are no schools used computer as mind tools in mathematics. In the other hand, the teachers haven't known the software to supports the learning of mathematics. In addition, many teachers are able to use some software but have not been able to prepare their own computer-based learning materials. Therefore, the aim of this study was to produce an integrated ICT textbook that can be used by teachers and students to improve the effectiveness of learning mathematics. To facilitate teachers and students in using the computer program, the book comes with a CD tutorial. CD Tutorial consists of guide to use multiple software and examples of applied learning high school math class X semesters 1. The text book developed with Plomp model and refers to Tessmer formative evaluation. This article describe the validation of the mathematics textbook that based on ICT with a CD Tutorial. Self-evaluation and validation sheet are used as instrument.

2010 Mathematics Subject Classification: 97A10, 97A30.
Keywords: mathematics textbook, CD tutorial, design and validation.

P-35. Bankruptcy prediction of bond using time-varying default barrier as default time rule (empirical study in some Indonesian corporate bond data)

Di Asih I Maruddani*, Triastuti Wuryandari, Abdul Hoyyi
Department of Statistics Diponegoro University, Indonesia
{maruddani, triastuti, ahy_stat}@undip.ac.id

There are some default time rules to determine bankruptcy prediction of a bond. The classical default time is known as Merton Model. The most important characteristic of Merton's model is the restriction of default time to the maturity of the debt, not taking into consideration the possibility of an early default. If the firm's value falls down to minimal level before the maturity of the debt, but it is able to recover and meet the debt's payment at maturity, the default would be avoided in Merton's approach. The Black & Cox (1976) model, known as First Passage Time (FPT) and is corrected as Revised First Passage Time (RFPT), specify default as the first time the firm's asset value hits a lower barrier. It allows default to take place at any time. FPT and RFPT use constant value as the barrier. Time-varying default barrier was introduced by Hull & White (2001) dan Avellaneda & Zhu (2001) that using time-varying variable as a barrier. In this

paper, we will obtain the probability of default for the time-varying default barrier using straight forward integration method. Empirical study for some Indonesian Bond Data especially using the time-varying default barrier will be applied. And we will compare the result with classical model and the RFPT model.

2010 Mathematics Subject Classification: 03B48.
Keywords: classical model, default barrier, probability of default, revised first passage time, time-varying default barrier.

P-36. Analysis and description of authentic assessment in calculus subject

Zulfaneti*, Sofia Edriati, Mukhni
STKIP PGRI Sumatera Barat, Indonesia
{zulfaneti_stkippgri, sofia.edriati, muhkniajoo}@yahoo.co.id

The study was based on the need to carry out the actual evaluation process of the calculus college. To evaluate of the proses, lecturer have been needed assessment of authentic and comprehensive assessment that can improve the mathematical ability of students in calculus college. This study is the first phase of the three phases of development research of assessment tools to assess critical thinking, reasoning and mathematics communication students in calculus subject. The development research follows the Plomp development model consisting of three phases namely the preliminary research, prototyping phase, and assessment phase. The study aims to describe the need and the evaluation procedure adopted in the calculus college, which is a description of: (a) the type of assessment being applied and its procedure in the lecture Calculus, (b) the expectations of students to models of assessment are applied in teaching calculus, (c) the involvement of lecturers and students in the implementation of assessment in learning calculus. (d) specific skills and competencies required in calculus. The instrument used was the questionnaire, observation sheets and documents of planning calculus lectures. Interview conducted with lecturers and students were selected by purposive sampling, observations has done in the calculus and review of documents conducted on college planning documents. Interviews, observation and review of planning lectures were descriptive analyzed. The results showed that in the calculus teaching of assessment tools used lecturer is still limited to the cognitive assessment. Most of the assessment conducted by lecturers and not involve the assessment of students. However, gradually the lecturer has implemented of assessment tools to assess the attitude and psychomotor although the device does not have valid assessment, practical and effective. While a student, have an expectation that lecturers in conducting the assessment is not too focused on the test and ignore the assessment process.

2010 Mathematics Subject Classification: 97U10.
Keywords: assesment, authentic, critical thinking, mathematical reasoning, mathematical communication.

P-37. Attitudes towards Mathematics: effects of gender and school type

Alyaa Nadiah Mohamed, Fatimah Abdul Razak*
School of Mathematical Sciences, Universiti Kebangsaan Malaysia
alyaa.nadiah@gmail.com, fatima84@ukm.edu.my

Attitude and perception plays a crucial role in studying mathematics. This study was designed to investigate the different attitudes towards mathematics at the secondary school level. The purpose of this study is to highlight differences in attitudes towards mathematics based on the students' gender and their school type (single sex or coeducational school). A questionnaire was handed out to 180 secondary school students across three different schools in Kuching. Among the questions in the questionnaire were related to self-confidence in doing mathematics, whether boys are better than girls at mathematics and their perception about the usefulness of mathematics. The data collected were analyzed using the Statistical Package for Social Science (SPSS). The results indicate some differences in attitude towards mathematics between male and female students that are more pronounced when they are in different school types. Moreover, we propose using a fuzzy concept for the measurement of Likert-type scale to measure students' attitudes toward mathematics.

2010 Mathematics Subject Classification: 97C20, 97C60, 97A40.
Keywords: attitude towards mathematics, mathematics and gender, confidence in mathematics.

P-38. Analysis of early stage module development based on guided discovery on transformational geometry course at STKIP PGRI in West Sumatra

Rina Febriana, Yulia Haryono
STKIP PGRI Sumatera Barat, Indonesia
{rinafebriana0502, yuliaharyono85}@gmail.com

This research was conducted as a process during the course of transformational geometry subject has been using the lecture and textbook methods. Based on researcher's observations, the use of conventional method causes monotonous lectures and the use of textbooks in the lecture has not been able to construct students' knowledge. This causes the students to be less motivated to learn independently.The aim of this research is analyze of early stage module development based on guided discovery on Transformational Geometry course at STKIP PGRI in West Sumatera.The development of research is using the 4D model. The steps are define, design, develop and disseminate. This study has recently come to the define phase, which is the stages are: (a) Conducting interviews with colleagues, in order to understand the problems/ obstacles encountered in the field related to the Transformational Geometry lecture. (b) Analyzing the curriculum and syllabus of Transformational Geometry, in order to determine the suitability of the materials with the expected competencies. (c) Analyzing textbooks of Transformational Geometry. (d) Studying the characteristics of the students, in order to make it easier

to develop the development design. It is done by deep interviews with both lecturers and students. Interviews showed that the difficulties of students in the subject of transformational geometry are students' lack of understanding on the basic concepts of geometry and students' inability to prove the proposition, therefore, it is necessary to have teaching materials in the form of modules. The module that is expected by the students in this study is a module which includes the complete material and can guide students in finding a proof of concept or proposition. In analyzing syllabus and literatures, what was done is by looking at the suitability of the material being taught with the syllabus used.

2010 Mathematics Subject Classification: 97U20.
Keywords: development research, analyze, module, transformational geometry.

P-39. Associations between mathematics classroom learning environtments and achievement in University of PGRI Adi Buana Surabaya Indonesia

Erna Puji Astutik
University of PGRI Adi Buana Surabaya, Indonesia
ernamzduta@gmail.com

This study described the mathematics classroom learning environment in mathematics education department of University of PGRI Adi Buana Surabaya Indonesia. The aims of this study were to describe the students' perceptions of mathematics classroom learning environments and examine the associations between the students' perceptions of mathematics classroom learning environments and students' achievements. This study used questionnaire to gather students' perceptions of their mathematics classrooms learning environments; the What Is Happening In the Classroom (WIHIC) questionnaire was administered to a sample of 280 students in mathematics department of University of PGRI Adi Buana Surabaya Indonesia to examine the validity of the questionnaire and 150 of them will be used to describe the students' perceptions of their mathematics classrooms learning environments and the relation of those perceptions to students' achievements. For the students' achievements, there were cognitive achievement that was gathered from students' grade point average (GPA) and affective achievement that was gathered from Test of Mathematics Related Attitude (TOMRA). The data from those questionnaires and students' GPA were then used to describe the relationship between students' perceptions of mathematics classroom learning environments and students' achievements by using Pearson Product-Moment Correlation. Associations was found between mathematics classroom learning environments and students' cognitive achievement in which Involvement and Task Orientation scales were significantly correlated with students' cognitive achievement. However, for Students Cohesiveness, Order and Organitation, Cooperation, and Equity scales had small correlations with students' cognitive achievement. Associations was also found between mathematics classroom learning environments and students' affective achievement in which all the classroom learning environments scales was

significantly correlated with students' affective achievement.

2010 Mathematics Subject Classification: 97B10.
Keywords: mathematics classroom, learning environments, students' achievement, attitude toward mathematics.

P-40. Analysis prior knowledge students metacognition STKIP PGRI west Sumatera in problem solving

Dewi Yuliana Fitri*, Merina Pratiwi, Villia Anggraini
STKIP PGRI West Sumatera, Indonesia
{dewiyulianafitri2, merinapratiwi1920}@gmail.com, villia_doang@yahoo.co.id

Along with the development of the cognitive aspects of learning outcome achievement, students just looks at the cognitive goals regardless of knowledge of metacognition. The purpose of this research is to know the prior knowledge students metacognition STKIP PGRI West Sumatra in problem solving. This type of research is research survey with cross sectional analytic study with sample withdrawal methods are purposive sampling. The sample of this research was the student of mathematics education that is as much as 40 respondents. Data collection research using observation learning student management strategies, metacognition in problem solving, prior knowledge students metacognition. Based on the analysis of the data is done through observation and management strategies of learning students and students' metacognition question form in problem solving is obtained that for the learning process of the students already have and use the ability of metacognition with metacognition ability in early problem solving 54.5%, resolution of 37,4% and 8.1%, as well as evaluating the test the prior knowledge students metacognition earned the difficulty in solving the problem because the learning process has not been effective (15,87%), limited student activity and less geared to exploring consciousness and setting process of thinking in solving problems (31,62%), how the delivery of the subject matter of the lecturer to the students in the class include a describes the activities of the material at the beginning of the lessons are interspersed with q & a, discussing examples of the problem, and the granting of individual tasks , make students tend to be passive (16.56), and students are accustomed to obtaining knowledge from lecturer,attributing knowledge through memorizing without drafting knowledge itself, and less to grow skills and self-reliance and self-confidence of students (35.95). The results showed that students' metacognition in problem solving students of STKIP PGRI West Sumatra are still low.

2010 Mathematics Subject Classification: 97B20.
Keywords: prior knowledge, metacognition, problem solving.

P-41. Analysis student's interest towards geometry learning with origami

Dinna Cilvia Asri*, Ayu Mentari*, Nerru Pranuta Murnaka
STKIP SURYA, Indonesia
{dinna.cilvia, ayu.mentari}@students.stkipsurya.ac.id, nerru.pranuta@stkipsurya.ac.id

The aims of this research are (1) to analyze student's interest who studied geometry with origami and (2) to analyze student's obstacle who used conventional method in geometry learning. This research is a descriptive qualitative research which is describes student's interest towards geometry learning with origami. In this research, interview and documentation are technique for collecting data. Analysis of data used comparison data of interview and documentation from sample in this research. The sample in this research is students from one of elementary school in Tangerang. Some of previous research show that origami can be used in geometry learning. In this research, origami is used to simplify student's learning about symmetrical of plane.The conclusion of this research is students shown positive's interest in geometry learning with origami. It can be seen from their enthusiasm while learning process and interview result. Some of students describe if they are very happy and helpful to understanding symmetrical of plane in concrete way. Besides that, for students who are not learning with origami felt difficult in geometry learning, especially in identifying characteristic symmetrical of plane. Researcher also recommended origami as one of alternative medium which is can be used by teacher in teaching symmetrical of plane.

2010 Mathematics Subject Classification: 97B20.
Keywords: geometry, origami, student's interest.

P-42. Developing of SMART based teaching and learning sets of geometry for grade VII

Muchamad Subali Noto*[1,2], Yulyanti Harisman[1,3], Asem Amam[1,4]
[1]Indonesia University of Education, [2]Swadaya Gunung Djati University, Indonesia
[3]STKIP PGRI Sumatera Barat, [4]Galuh University, Indonesia
msubalinoto@student.upi.edu, yulyyuki61@gmail.com, amam@student.upi.edu

This article discusses about a development research of designing SMART (Specific, Measureable, Achievable, Realistic, and Time-bound) based teaching and learning sets of geometry for grade VII. The goal of this research was to produce teaching and learning sets, which should be valid and effective in its implementation. The process developing of teaching and learning sets in this research used the modification of Thiagarajan 4-D model (became 3D), which were (1) define, (2) design, and (3) develop. The teaching and learning sets developed (product) were (1) syllabus, (2) teaching plan, and (3) module with SMART characteristics. The field test was held at a senior high school in Pekalongan as the population of the research with eight parallel classes. Data were collected from validation and observation sheets, and from the test results of learning achievement. Data were

analyzed descriptively, analyzed by t-test and by regression. The results of research were as follows (1) the teaching and learning sets were valid after revising based on feedbacks from experts and colleagues, and (2) the teaching and learning sets were effective because already fulfill three indicators of effectiveness. The research results show that the validity score of syllabus was 3.36, the validity score of teaching plan was 3.24, and the validity score of module was 3.23 (of the highest score 4). The first one of fulfill indicators of effectiveness in this research was that student's achievement reached the classical accomplishment criteria 69.33 more than KKM 65, and individual accomplishment more than 75 percent. The second one was that the student's activeness influenced by 80.30 percent towards students' learning achievement. The third one was that there was a difference of learning achievement between students of experiment class by the average 69.33 and students of conventional class by the average 61.60. Based on the research results, which show valid teaching and learning sets and effective teaching and learning activities, the author claims that the goal the research was fulfill.

2010 Mathematics Subject Classification: 97A30.
Keywords: learning geometry, SMART based, teaching and learning sets.

P-43. Analysis of Yahalom, wide-mouth-frog and needham schroeder protocol using BAN logic: a survey

Annisa Dini Handayani[1], Amrizal Arif Rakhmadi[2]
[1]Sekolah Tinggi Sandi Negara, Indonesia, [2]Lembaga Sandi Negara, Indonesia
annisa.dini@stsn-nci.ac.id, amrizal.arif@lemsaneg.go.id

Mathematical logic is a subfield of mathematics that can be used to analyze cryptographic protocol. One of methods of mathematical logic commonly used is BAN Logic. It is used to formalize the description and to analyze steps of authentication protocols. It also can be used to detect flaws in security protocols. In this paper we have tried to survey how BAN Logic works and how to apply it to Yahalom, Wide-Mouth-Frog and Needham Schroeder protocol, three of authentication protocol used to exchange a key in a cryptosystem. Every state in these protocols should be transformed to notation and symbols as stated in basic rules defined by BAN logic. It is showed that Yahalom, Wide-Mouth-Frog can be analyzed using BAN logic and each step in these protocols work properly. It is also showed that BAN logic cannot be used to assure that encryption/decryption function work improperly.

2010 Mathematics Subject Classification: 03A10.
Keywords: authentication protocol, cryptosystem, Yahalom, wide-mouth-frog, Needham Schroeder protocol, BAN logic, encryption/decryption function.

P-44. The development of teachers′ lesson design through continuous review and role playing activities

Indira Puteri Kinasih
Mathematics Education Department of IKIP Mataram, Indonesia
indiraputeri@gmail.com

Designing a mathematics lesson is one of the essential part in the learning process. A well design lesson can lead and help teachers to deliver mathematics with an appropriate and linked sequences so that students will have an opportunity to engage dan develop their mathematical thinking. This study describe the evolution of mathematics lesson design developed by junior high school teachers in West Nusa Tenggara, Indonesia. The lesson design were analyzed using ELPSA (Experience, Language, Pictorial, Symbol, Application) learning framework and hypothetical learning trajectory theory. Continuous review and role playing activities which is intended to demonstrate a certain lesson plan were conducted to enhance both of teachers? content and pedagogical knowledge that enabled them to re-thinking and re-designed their lesson plan after experiencing those activities. Two lesson design are given as examples to describe the evolution that occurs during development period. Teachers as the lesson designer were interviewed about their insightful impression as they continue to develop their lesson design subsequent to guiding assistance from mathematics experts.

2010 Mathematics Subject Classification: 97D80.
Keywords: ELPSA, HLT, lesson design, role play.

P-45. Open-ended problem solving of circle based on polya stage towards students of state junior high school 5 Salatiga

Novisita Ratu*, Erlina Prihatnani
Satya Wacana Christian University, Indonesia
novisita.ratu@staff.uksw.edu, erlina.prihatnani@gmail.com

The purpose of this research is to determine steps taken by Junior High School students to solve Mathematics problems based on Polya Stage. This research is a qualitative descriptive research. The subject of this research was taken with purposive sampling which are 3 students of State Junior High School 5 Salatiga (SMP N 5 Salatiga) with high level, medium level, and low level of ability. The result of this research shows that problem solving capabilities of student with high and medium level include: 1) to understand the problem while student can determine what is known and what is being asked correctly, and able to determine the adequacy of the information to answer the question; 2) to develop a plan of problem solving where student can determine the relationship between information and other information that is not known in the matter, being able to use all of the important information and be able to plan problem solving; 3) to implement the solution planning where student is able to use the steps regularly and tend to be

skilled in the accuracy of the algorithm and answer the questions; 4) to evaluate, where students have not do the overall check yet both in the calculation process and the steps undertaken. On the other side, student with low level didn't have that four capabilities.

2010 Mathematics Subject Classification: 68T20.
Keywords: open-ended, problem solving, polya stage.

P-46. Student's understanding of graphics-based information processing

Helti Lygia Mampouw[1], Agung Lukito[2], St Suwarsono[3]
[1]Satya Wacana Christian University
[2]State University of Surabaya, [3]Sanata Dharma University
helti.mampouw@staff.uksw.edu, gung.lukito@yahoo.com, stsuwarsono@gmail.com

The meaning of an experience is determined by the processing of the received information. Here, the information processing steps consist of receiving the stimulus, encoding, storing, and retriving information. This paper aims to describe the students' information processing when interpreting the graphics, where the task is delivered using takjil context. Provided that the ability to elaborate and depth of information processing in the encoding process and characteristic of the subject interpretation is not entirely determined by mathematical ability, but also is determined by the breadth of information network and activation of prior information about the given context. The study suggests that the student needs to acquire more varied experience on problem solving so that they can be connected with a lot of things when solving problems and have the ability to retrieve the right information. Thus, problem solving can help be the entrance to understanding mathematical concepts and know how to work math concepts in everyday life.

2010 Mathematics Subject Classification: 68P30.
Keywords: information-processing, graphics, encoding, storage, retrieval, takjil.

P-47. Elementary school students' multiple intelligence in mathematics problem solving

Hanim Faizah
University of PGRI Adi Buana Surabaya, Indonesia
hanim06b@gmail.com

The aim of this research was to describe student's multiple intelligence in mathematics problem solving. The data of this research were gathered from sixteen fifth grade students of elementary school, MI Hasanuddin Tebel-Gedangan-Sidoarjo-Indonesia by using test and interview. In the first step, students were given test to determine the subject according to their multiple intelligence. In the second step, the students were then given mathematics problem solving test to gather the data about their way in solving the mathematics problem. By using the data in second step, students were interviewed to examine their work. From the collected data can

be concluded that the dominant multiple intelligence effected the way of students' problem solving.

2010 Mathematics Subject Classification: 97A30, 68T20.
Keywords: multiple intelligence, problem solving, elementary school students.

P-48. The development of learning media based interactive math comic for students of VIII grade of junior high school

Niniwati*, Rahmanda Saputra
Bung Hatta University, Indonesia
niniwati64@gmail.com, saputra.rahmanda@yahoo.co.id

The development of science and technology increasingly increase the pace of an increase in the field of education. Teachers are expected to be able to utilize the results of development of technology in form of learning media whom appropriate and interesting. Low interest of students in following the process of math learning and the students' difficulty in comprehending cube and cuboid material on the material cube elements, cuboid, and formula become constraint that are faced by the teachers to achieve the goals learning. Based on the problems above, the writer wanted to make and to develop learning media of interactive math comic in cube and cuboid material. This math media was expected to be able to help the teachers in explaining material and to improve students' comprehension. This learning media was developed with interactive comic base. Therefore, this media will be equipped with materials, examples, and evaluation. It was based on the relevant material. After that, it was packed in form of CD interactive learning media. The purpose of this research was to produce a valid and practical CD of media learning interactive comic math. The design of this research was development research. The researcher used model of product development that was learning using computer. This model is consist of six steps, they are: 1) concept, 2) design, 3) collecting materials, 4) assembly, 5) testing 6) distribution. In this research, the researcher only used five steps; they are concept, design, collecting materials, assembly, testing. Validity was done by two lecturers and one teacher to see whether this learning media have been valid or not. Based on the result of validity test questionnaire was gotten 87.50 as valid criteria. Meanwhile, practicality test with 26 students were to see whether this learning media was practical to be used or not. Based on analysis result of students practicality questionnaire sheets were gotten 89.29% as practical criteria. Therefore, it could be concluded that an interactive CD media of math comic learning for cube and cuboid material for grade VIII of Junior High School was valid and practical used as math learning media. Based on the result of this research, the researcher suggested that to conduct further research to examine the effectiveness and innovation of learning media because in this research was limited until trial on the students.

2010 Mathematics Subject Classification: 97.
Keywords: comic, interactive, math education media.

P-49. Future rural area pre-service teachers' mathematics anxiety

Bobbi Rahman, Novi Purnama Sari*, Lilis S. J. Manullang, Sari Juliana
STKIP Surya, Indonesia
{rahmanbobbi, novinovipurnama, lilismanullang, sariayi20}@gmail.com

This research is about mathematics anxiety of pre-service teachers who are students in STKIP Surya which is located in the heart of Tangerang City. Pre-service teachers here means all students who have done taking field experience programs as one of the coursework. They are prepared to become secondary and high school mathematics teachers in the region where they are from. In general, they are from a rural area in the central till eastern point of Indonesia like Kuala Pembuang regency in Central Borneo Province, Kupang regency in East Nusa Tenggara Province, and Merauke in Papua Province. It is important to analyze how mathematics anxiety towards them as they are going to face an extremely different condition between teaching as a pre-service teacher in a city where they studied and in a rural area once they are graduated in the future. Questionnaires are used as data collection to know participants' view toward mathematics anxiety. Depth interview have been conducted with some participants based on the area they are from. This research provides a description pre-service teachers' mathematics anxiety and how it is effected pre-service teachers' teaching skills as one of the teachers in rural area in the early future.

2010 Mathematics Subject Classification: 97-02, 97A40, 97B20.
Keywords: mathematics anxiety, pre-service teachers, rural area.

P-50. The structural equation modeling (SEM) and its application on factors modeling which are effected on students' academic achievement (case study: Universitas Surabaya)

Lina Natalya[1], Muhammad Mashuri[1], Ide Bagus Siaputra[2]
[1]Department of Statistics, Institut Teknologi Sepuluh Nopember
[2]Faculty of Psychology, Universitas Surabaya
ln_natalya2012@yahoo.co.id, {mashuri1962, siaputra}@gmail.com

Structural Equation Modeling (SEM) is the second generation of multivariate analysis technique which is based on causality between complex variables. SEM is the most appropriate analysis technique for social study because SEM can analyze latent variables. There are two SEM methods which are widely used, that are variance based SEM (VB-SEM) and covariance based SEM (CB-SEM). VB-SEM is developed with non-parametric approach and does not have to be used in big number of sample and normal distribution. While CBSEM is developed with parametric approach which has to be used in big number of sample and normal distribution. The purpose of this study is to evaluate the SEM method. Therefore, this study can find the appropriate method to analyze factors which can effect academic achievement, especially academic achievement of Universitas Surabaya's

students. The factors used in this research are six non-intelectual factors which are theoretically effected on academic achievement. The six factors are procrastination, academic motivation, self-esteem, perfectionism, self-control, and boredom. Beside evaluating the SEM method and finding the most appropriate method, this study is also expected to generate the best model for describing factors effecting academic achievement.

2010 Mathematics Subject Classification: 62D05, 62H25, 62H99, 62P15.
Keywords: Structural Equation Modeling (SEM), variance based, covariance based, academic achievement.

P-51. Teacher's knowledge of students in learning mathematics on limit of fucntion material

Ma'rufi*[1], I Ketut Budayasa[2], Dwi Juniati[2]
[1]Universitas Cokroaminoto Palopo, Indonesia, [2]Universitas Negeri Surabaya
marufi.ilyas@gmail.com, {ketutbudayasa, dwi_juniati}@yahoo.com

This research aims at describing the profil of high school teacher's Pedagogical Content Knowledge in learning mathematics from the perspective of teaching experience. Pedagogical Content Knowledge (PCK) covers teacher's knowledge of subject matter, knowledge of pedagogy, and knowledge of students. The subject of this research was two high school mathematics teachers who have different teaching experience. The data were obtained through interview and observasion then analyzed qualitatively. The focus of this research is the novice teacher's PCK deals with knowledge of students. Knowledge of Student is defined as teacher's knowledge about the students' conception and misconception on limit of function material and teacher's ability to cope with students' difficulty, mistake, and misconception. The result of this research shows that novice teacher's ability in analyzing the cause of students' difficulty, mistake, and misconception was limited. Novice teacher tended to overcome the students' difficulty, mistake, and misconception by re-explaining the procedure of question completion that not understood by the students.

2010 Mathematics Subject Classification: 97C70.
Keywords: knowledge of students, conception, misconception, limit of function, novice teacher.

P-52. The development of learning equipment in applying character-based learning model by involving emotional intellegence in compiling basic research proposal of teacher-candidate students

Muhammad Ilyas
Universitas Cokroaminoto Palopo, Indonesia
muhammadilyas949@yahoo.com

This research is a developmental research because the researcher aims to produce learning equipment to apply character-based learning model by involving emotional intellegence in compiling basic research proposal of teacher-candidate

students. The equipment consists of (1) lesson plan, (2) students' handbook, (3) teacher's handbook, and (4) students' work sheet. The model of equipment development in this research refers to 4-D Thiagarajan model by Semmel & Semmel which consists of define, design, develop, and disseminate. Define stage covers five stages, namely: (1) initial condition analysis, (2) students' analysis, (3) material analysis, (4) task analysis, and (5) learning objective specification. Design stage covers: (1) test composing, (2) media selecting, (3) format choosing, and (4) initial design of prototype I1 (equipment and instrument). In develop stage, prototype I1 is validated by the experts. The result of the validation is used as an input for the betterment of prototype II1. Then, prototype II1 is tested. In this research, the test was done twice. The first test was done in class VId and the second d test was done in class VIe of Mathematics Education Study Program Cokroaminoto Palopo University. The result obtained in test I is: (1) the learning equipment was practical but there were several expert's suggestions that should be considered to improve the practicality of the equipment, (2) the learning equipment was not effective because the classical completeness was not achieved and the students' activity was not as expected, although the teacher's ability in organizing learning was in high category and students' response were in positive category. The results of the analysis used to revise the equipment before test II are: (1) learning equipment was practical, (2) learning equipment was effective because the classical completeness was obtained, students' activity was as expected, teacher's ability in organizing learning was in high category, and the students' response was in positive response. Thus, in test II, prototype III obtained was valid, practical, and effective, and continued with disseminate stage to get final prototype. After passing through the four stages of development above, a learning equipment was obtained by applying cognitive strategy in completing mathematical problem which valid, practical, and effective.

2010 Mathematics Subject Classification: 97C30.

Keywords: learning equipment, character-based learning model, emotional intelligence, basic research proposal, teacher-candidate students.

P-53. Developing learning of plane area concepts at elementary level using prior knowledge and stored new knowledge

Abdul Muin[1], Didi Suryadi[2], Kadir[1]
[1]UIN Syarif Hidayatullah Jakarta, [2]Universitas Pendidikan Indonesia
abdul.muin@uinjkt.ac.id, didi-suryadi@staf.upi.edu, kadir@uinjkt.ac.id

Creating learning materials are important in mathematics learning developing, especially learning of mathematics at the elementary level. Design of developed teaching materials will affect the acquisition and acceptance by learners. The purpose of this paper is to design learning by using prior knowledge and new knowledge stored. The scope of the study includes the determination of the substance of learning, the selection of learning outcomes, identification of prior knowledge is

required, and the use of prior knowledge and the creation of new knowledge that is incorporated into the cognitive structure to be come others prior knowledge of learners. The substance of mathematical learning is the concept of plane area. The achievement of learning outcomes selected is to master the basics concept of plane area, to derive all concept of plane using prior knowledge and new knowledge stored, and to solve the problems related to the plane area concepts. The conclusion is that the learning materials are built using the principle of reflective learning

2010 Mathematics Subject Classification: 97C30.
Keywords: prior knowledge, stored new knowledge, reflective learning.

P-54. The effects of group investigation method on student's critical thinking in mathemathics education

Qurniawan Agung Putra, Nerru Pranuta Murnaka
STKIP Surya Tangerang
qurniawan.edu@gmail.com, nerru.pranuta@stkipsurya.ac.id

Group Investigation (GI) is one of many type of cooperative learning that use student oriented. This method is expected to work well in the development of student's critical thinking skill because it is require the students active investigate the problem of mathematics. This skill is essentially needed to challenging the change of world that require advance thinking level. The aim of this research is to investigate the e?ects of GI method in developing student's critical thinking skills in mathematics education. This research is pre-experimental research with one group pretest-posttest design. This is carried out in a 8th grade students from one of junior high school in Tangerang city, Indonesia based on purposive sampling technique. The selected class apply a teaching method that is GI. The data obtained on test and quisioner. The result show that Group Investigation method has a good response and more positive e?ects on developing student's critical thinking skills. This is shown by the results of the data processing using comparative hypothesis testing. Based on the results and discussion of the research, it has several conclusion. First, we need teaching method development especially based on student oriented learning in order to increase student's thinking comprehension. Second, cooperative learning can be a solution in developing student's critical thinking skills. Third, GI can be suitable method in build student's critical thinking in mathematics education.

2010 Mathematics Subject Classification: 97A99, 97C70, 97M99 .
Keywords: group investigation, student's critical thinking, mathematics education.

P-55. The role of ethnomathematics in West Java (case study in Cipatujah)

Dianne Amor Kusuma*[1], Stanley P. Dewanto[1], Budi Nurani Ruchjana[1]
Atje Setiawan Abdullah[2]
[1]Department of Mathematics Universitas Padjadjaran, Indonesia
[2]Department of Computer Science, Universitas Padjadjaran, Indonesia
{amor, stanleydewanto.mpd, budi.nurani, atje.setiawan}@unpad.ac.id

Indonesia is a multicultural country that has diverse cultures in each region. In many cultural aspects that a?ect, among others, from the ethnomatematics, how people use mathematics in cultural life. This paper is a study of the correlation between culture and mathematical concepts. This paper also reveals the mathematical practices of everyday life, especially in West Java in applying ethnomathematics approach in learning math in elementary school. The purpose of research is to show that ethnomathematics plays an important role in everyday life, especially for elementary school students and for the community Cipatujah, West Java. The method is implemented in this paper is exploration. The results showed that people Cipatujah been using ethnomathematics in their lives for many years and believe that ethnomathematics is part of the roots of their lives, however, for math teachers still need to be investigated further how to implement the approach ethnomathematics in the process of learning mathematics in primary schools in Cipatujah.

2010 Mathematics Subject Classification: 01A07, 97A30, 97A40.
Keywords: ethnomathematics, root of culture, Cipatujah.

P-56. Identification Junior High School student's critical thinking skills

Qopa Almaisurie, Nerru Pranuta Murnaka
STKIP Surya Tangerang
qopalmai25@gmail.com, nerru.pranuta@stkipsurya.ac.id

The challenges in 21st century as the information age encourages each individuals to increase their thinking skills to could compete in that time. Thinking skills always evolving and can be learned (Nickerson, 1985), therefore must be procured to students. One of thinking skills that must be possessed by students is critical thinking. Critical thinking is one of higher order thinking skills that requires to be able to created a new idea that made up of old ideas combined in a new way to have a solution of the problem that given. The simplest way to do this is by adding, replacing, or subtracting ideas. In fact, is hard to bring that skill up, even teaching students how to think critically is an essential issue in educational settings (Facione, 2007 ; sendag, Odabasi, 2009). One of the cause is a learning method that still concered on the teacher (teacher-centered). The aim of this research is to identi?ed and desrcribe the critical thinking ability of students based on the instrument that have been created by researchers in form of questions and questionnaire. This is carried out in a 8th grade students from one of junior

high school in Tangerang city, Indonesia. This research is descriptive qualitative. The data obtained in this research showed that critical thinking of junior high school students still low. Thus, essentially needed the di?erent teaching method to increase the critical thinking of junior high school students.

2010 Mathematics Subject Classification: 97A99, 97C99.
Keywords: higher order thinking skills, critical thinking, descriptive qualitative.

P-57. Design for abstraction: a case study on pre-service mathematics teachers

Farida Nurhasanah
Sebelas Maret University, Indonesia
f4121da_n@yahoo.com

Experience in constructing mathematical concepts is essential for pre-service mathematics teachers. Their experiences will enrich them with pedagogical content knowledge (PCK) skill. Abstraction is one of the processes in mathematical constructions. This process is difficult to be expected happen naturally in the classroom. A context needs to be designed to facilitate this process. Design of a context for abstraction for pre-service mathematics teachers is discussed in this paper. The context was designed based on the framework of Abstraction in Context (AiC). Processes of abstraction based on AiC have three stages: need, emergence, and consolidation. The topic of "Parallel Coordinates" intentionally has been chosen as a new concept for pre-service mathematics teachers. This concept belongs to un-conventional mathematics concepts.

2010 Mathematics Subject Classification: 97B10.
Keywords: knowledge construction, parallel coordinate, context, abstraction.

P-58. Preservice teacher's segmentation and fragmentation in solving mathematics problems using cognitive mapping

Wyrasti A. F., Sa'dijah C, Mulyati S., Sulendra I. M.

This study described about how segmentation and fragmentation occurs in the mind of the student when doing some mathematics problems. This segmentation and fragmentation will be outlined by a cognitive mapping. We used cognitive identification task (CIT) to get student's cognitive structure data to see how segmentation and fragmentation occurs in the mind of the student. Subject in this study were chosen based on that. Data collection conducted using think aloud method.

2010 Mathematics Subject Classification: 91E10.
Keywords: segmentation, fragmentation, cognitive mapping.

P-59. Differences between mathematical creative thinking abilities of students are taught with realistic mathematics education approach and deductive in UHAMKA Jakarta

Sigid Edy Purwanto
Dept. of Math. Edu., University of Muhammadiyah Prof. Dr. HAMKA
sigidmath@yahoo.co.id

This research aims to determine whether there is any differences between mathematical creative thinking abilities of students are taught with Realistic Mathematics Education and Deductive. Research conducted on Abstract Algebra students consist of 25 students who were taught with a Realistic Mathematics Education approach and 25 students were taught by a deductive approach. The research method used is Quasi Experiment design. The independent variables in this research was Realistic Mathematics Education approach and Deductive approach, while the dependent variable was mathematical creative thinking abilities of students. The conclude of this research is there are differences between mathematical creative thinking abilities of students are taught with Realistic Mathematics Education and Deductive.

2010 Mathematics Subject Classification: 97A30.
Keywords: realistic mathematics education, deductive approach, creative thinking.

S02. Algebra / Lie Theory and Generalizations, Number Theory

Invited Talks

IT-01. Some aspects of representation theory of GL_n and classical groups over a non-archimedean local field

Erez Lapid*[1], Alberto Mínguez[2], Marko Tadić[3]
[1]Weizmann Institute of Science
[2]Institut de Mathématiques de Jussieu [3]University of Zagreb
erez.m.lapid@gmail.com, alberto.minguez@imj-prg.fr, tadic@math.hr

The representation theory of the general linear group over a non-archimedean local field was studied in depth by Bernstein and Zelevisnky in the 1970's. Recently some progress has been made on irreducibility question for parabolic induction. In particular, this gives a different approach for the classification of the admissible and unitary dual, which works uniformly for non-commutative fields. Applications to classical groups will also be discussed

2010 Mathematics Subject Classification: 22E50.
Keywords: representation theory, general linear group, classical gruops.

IT-02. Hopf linear categories over a group and their fundamental group

Claude Cibils
Institut Montpelliérain Alexander Grothendieck, IMAG
Université de Montpellier, France
Claude.Cibils@umontpellier.fr

Consider a linear category over a field, which objects are a finite group G. Then we introduce a Hopf structure on the category, obtaining a "Hopf linear category over G". If the group G is trivial this corresponds precisely to a usual Hopf algebra. Alternatively, if G is not trivial but there are no morphisms between different objects besides zero, one recovers the Turaev-Virelizier Hopf G-coalgebras. We will define the fundamental group "à la Grothendieck" of a Hopf linear category over G - which is an abelian group. Then we will relate this invariant with the intrinsic fundamental group of the underlying linear category. In this talk we will also compute this new invariant for Taft categories. We will also give its value for the Hopf algebras of cyclic groups of small orders, obtaining interesting abelian groups which are comparable to stable homothopy groups of spheres. This is work in progress with Andrea Solotar.

2010 Mathematics Subject Classification: 16S40, 16B50.
Keywords: Hopf, fundamental group, category.

IT-03. Characterisation of the Berkovich spectrum of the banach algebra of bounded continuous functions

Tomoki Mihara
Tokyo Institute of Technology, Japan
mihara@ms.u-tokyo.ac.jp

We give a characterisation of the Berkovich spectrum of the Banach algebra of bounded continuous functions on a topological space. This result yields a generalisation of the functorial construction of the Banaschewski compactification of a Hausdorff uniform space. We obtain several applications such as the Gal'fand theory for non-Archimedean compactifications and the automatic continuity theorem for algebra homomorphisms.

2010 Mathematics Subject Classification: 14M27.
Keywords: p-adic, Berkovich spectrum, Banaschewski compactification, functional analysis.

IT-04. Quantum ortho-symplectic superalgebras and crystal bases

Jae-Hoon Kwon
Seoul National University, Korea
jaehoonkw@snu.ac.kr

We introduce a semisimple tensor category of modules over the quantum group associated to an ortho-symplectic Lie superalgebra, whose object is of infinite dimension in general, but has nice properties including a Weyl type character formula. The construction of this category is based on the theory of super duality for representations of ortho-sympelctic Lie superalgebra by Cheng-Lam-Wang. We show that a simple module in this category has a unique crystal base in the sense of Kashiwara, with an explicit combinatorial realisation.

2010 Mathematics Subject Classification: 16T20, 17B01.
Keywords: quantum group, Lie superalgebra, crystal base.

IT-05. Dimer models and Grassmannian cluster categories

Karin Baur
University of Graz
baurk@uni-graz.at

Joint work with A. King (Bath) and R. Marsh (Leeds) and with D. Bogdanic (Graz). A dimer model can be defined as a quiver embedded into a surface in such a way that the complement is a disjoint union of disks with oriented boundaries. Such models can also be considered in the case of a surface with boundary. The Postnikov diagrams used by J. Scott to describe the cluster structure of the homogeneous coordinate ring of the Grassmannian give rise to dimer models on a disk in this sense. We associate a natural algebra to such a dimer model. This algebra is a modified version of the corresponding Jacobian algebra, taking the boundary into

account. Taking the sum of the idempotents corresponding to boundary vertices, we obtain an idempotent subalgebra, which we call the boundary algebra. We show that it is independent of the choice of dimer model and coincides with an algebra that B. Jensen, A. King and X. Su have used to model the cluster structure of the homogeneous coordinate ring of the Grassmannian categorically. We also study homological properties of the Frobenius category of maximal CM modules over this boundary algebra.

2010 Mathematics Subject Classification: 13F60, 16G50, 82B20.
Keywords: dimer models, frozen Jacobi algebra, cluster category.

IT-06. Recent updates on homological invariant of Bieberbach groups

Nor Haniza Sarmin*[1], Siti Afiqah Mohammad[1], Hazzirah Izzati Mat Hassim[1]
Norashiqin Mohd Idrus[2], Rohaidah Masri[2], Yee Ting Tan[2]
[1]Universiti Teknologi Malaysia, [2]Universiti Pendidikan Sultan Idris
nhs@utm.my, afiqahmohammad91@gmail.com, hazzirah@utm.my
{norashiqin, rohaidah}@fsmt.upsi.edu.my, yeeting07@yahoo.com.my

Homological invariants or homological functors of groups have their roots in algebraic K-theory and homotopy theory. They were first used in algebraic topology, but are common in many areas of mathematics. The homological invariants are also used in group cohomology to classify abelian group extensions. Researches on homological invariants have grown intensively over the years. In this paper, recent updates of the homological invariants of Bieberbach groups with certain point groups will be presented. Furthermore, one of the homological invariants which is the central subgroup of a Bieberbach group with quaternion point group of order eight is computed.

2010 Mathematics Subject Classification: 12G05.
Keywords: Homological invariants, Bieberbach groups, point group.

IT-07. Moufang loops of odd order $p^4q_1^3\cdots q_n^3$

Andrew Rajah*, Lois Adewoye Ademola
School of Mathematical Sciences, Universiti Sains Malaysia
andy@usm.my, loisola@yahoo.com

There is a close relationship between groups and Moufang loops. For example, both of them have a unique inverse element for each element in the underlying set, satisfy the Lagrange property as well as the first two Sylow's theorems. Moreover, like groups, Moufang loops of odd order are solvable. However, unlike groups, Moufang loops need not be associative. Rather, they satisfy four equivalent identities called the Moufang indentities. The most generally used identity is $(x \cdot y) \cdot (z \cdot x) = (x \cdot (y \cdot z)) \cdot x$ which looks quite similar to the associative identity. The aim of our research is to **construct**, then **classify** classes of **nonassociative Moufang loops**, that is, Moufang loops that are not groups. Moufang loops of

even order have been successfully classified whereas for the odd cases, only those of order 3^4, p^5 (for primes $p > 3$) and pq^3 (for primes p and q with $q \equiv 1(mod\ p)$) have been classified. To construct larger classes of nonassociative Moufang loops, we need to eliminate those cases for which nonassociative Moufang loops cannot exist. We present here the latest case of nonexistence by proving that for distinct odd primes $p, q_1, \cdots, q_n$ with p being the smallest prime, $q_i \not\equiv 1(mod\ p)$ and $q_i \not\equiv 1(mod\ q_j)$, **all Moufang loops of odd order $p^4 q_1^3 \cdots q_n^3$ are associative**.

2010 Mathematics Subject Classification: 20N05.
Keywords: Moufang, loop, associative, order.

Contributed Talks

CT-01. Varieties of U-complexes

Dellavitha Nasution
Algebra Research Group ITB
dellavitha@math.itb.ac.id

In chain complexes, Huisgen-Zimmermann and Saorin defined complex variety of bounded complexes with a fixed dimension array and show that there is a group action on that variety such that orbits correspond to isomorphism classes of that chain complexes. In this paper, the framework of chain complexes is extended to chain U-complexes of modules over a fixed algebraically closed field, where the notion of chain U-complexes was introduced by Davvaz and Shabani-Solt. The aim of this paper is to define variety of U-complexes with fixed dimension arrays for C and for U and show that there is a group action on that variety such that orbits correspond to isomorphism classes of U-complexes of the described format.

2010 Mathematics Subject Classification: 06B15, 14L30
Keywords: U-complex, affine variety, group action, Schur complement.

CT-02. Rank gain of Jacobians over finite Galois extensions

Bo-Hae Im*[1], Erik Wallace[2]
[1]Department of Mathematics, Chung-Ang University, South Korea
[2]The Einstein Institute of Mathematics, Israel
imbh@cau.ac.kr, eriktwallace@gmail.com

Let $\mathcal{X}$ be a Riemann surface of genus $g > 1$ defined over a number field K which is a degree d-covering of $\mathbb{P}^1_K$. In this paper we show the existence of infinitely many linearly disjoint degree d-extensions L/K over which the Jacobian of $\mathcal{X}$ gains rank. In the case where 0, 1 and ∞ are the only branch points, and there is an automorphism σ of $\mathcal{X}$ which cyclically permutes these branch points, we obtain the same result for the Jacobian of $\mathcal{X}/\sigma$. In particular if $\mathcal{X}$ is the Klein quartic,

then the construction provides an elliptic curve which gains rank over infinitely many degree 7-extensions of $\mathbb{Q}$. (This paper has been submitted for a publication and posted on ArXiv.)

2010 Mathematics Subject Classification: 14H40, 11G05.
Keywords: elliptic curves, Jacobian varieties, rank

CT-03. On weakly second submodules over noncommutative rings

Indah Emilia Wijayanti, Dian Ariesta Yuwaningsih, Sri Wahyuni
Mathematics Department of Universitas Gadjah Mada, Indonesia
ind.wijayanti@ugm.ac.id, dian.ariesta17@yahoo.com, swahyuni@ugm.ac.id

The notion of prime submodules has been generalized into weakly prime submodules. A proper submodule N of M is said to be prime if for any $r \in R$ and $m \in M$ with $rRm \subseteq N$, we have $m \in N$ or $rM \subseteq N$. A proper submodule N of an R-module M is said to be weakly prime submodules if for any $r, s \in R$ and submodule K of M with $rRsK \subseteq N$ implies either $rK \subseteq N$ or $sK \subseteq N$. The dual notion of prime submodules over a commutative ring with identity is second submodules. A nonzero submodule K of M is said to be second if for each $a \in R$, the homomorphism $f_a : K \to K$ is either an epimorphism or a zero homomorphism. Moreover, some authors have been introduced the dual notion of weakly prime submodules over a commutative ring with identity, that is weakly second submodules, and investigates some properties of this class of modules. In this work we generalize the notion of weakly second submodules over any ring with identity. A nonzero submodules N of M is said to be weakly second if for each $r, s \in R$ and submodule $K \in M$ such that $rsN \subseteq K$, implies either $rN \subseteq K$ or $sN \subseteq K$. Moreover, we investigate some properties of weakly second submodules related to completely irreducible submodules and prove some characterizations of weakly second submodules using the annihilators.

2010 Mathematics Subject Classification: 16D10.
Keywords: weakly prime submodules, weakly second submodules, completely irreducible submodules, prime submodules, second submodules.

CT-04. The nonabelian tensor square of a crystallographic group with quaternion point group of order eight

Siti Afiqah Mohammad∗, Nor Haniza Sarmin, Hazzirah Izzati Mat Hassim
Dept. of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia
afiqahmohammad91@gmail.com, {nhs, hazzirah}@utm.my

A crystallographic group is a discrete subgroup of the set of isometries of Euclidean space where the quotient space is compact. A torsion free crystallographic group, or also known as a Bieberbach group has the symmetry structure that will reveal its algebraic properties. One of the algebraic properties is its nonabelian

tensor square. The nonabelian tensor square is a special case of the nonabelian tensor product where the product is defined if the two groups act on each other in a compatible way and their action is taken to be conjugation. Meanwhile, Bieberbach group with quaternion point group of order eight is a polycyclic group. In this paper, by using the polycyclic method, the construction of the nonabelian tensor square of this group will be shown.

2010 Mathematics Subject Classification: 54C40.
Keywords: algebraic properties, Bieberbach group, quaternion point group.

CT-05. $*_p-$Modules and special class of modules determined by the essential closure of the class of all $*-$rings

Puguh Wahyu Prasetyo*[1], Indah Emilia Wijayanti[1], Halina France-Jackson[2]
[1]Mathematics Department, Universitas Gadjah Mada, Indonesia
[2]Mathematics Department, Nelson Mandela Metropolitan University, South Africa
puguhwp@gmail.com, ind_wijayanti@ugm.ac.id, cbf@easterncape.co.uk

A ring A is called a $*-$ring if A is a prime ring and has no nonzero proper prime homomorphic image. The $*-$ring was introduced by Korolczuk in 1981. Since $*-$rings have an important role in radical theory of rings, the properties of $*-$ring have been being investigated intensively. Since every ring can be viewed as a module over itself, the generalization of $*-$ring into module theory is an interesting investigation. We would like to present the generalization of $*-$rings in module theory named $*_p-$modules. An $A-$module M is called a $*_p-$module if M is a prime $A-$module and M has no nonzero proper prime submodule. According to the result of our investigation, we show that every $*-$ring is a $*_p-$module over itself. Furthermore, let A be a ring, M be an $A-$module, and I be an ideal of A with $I \subseteq (0 : M)_A$, where $(0 : M)_A = \{a \in A | aM = \{0\}\}$. We show that M is a $*_p-$module over A if and only if M is a $*_p-$module over A/I. On the other hand, the essential closure $*_k$ of the class of all $*-$rings is a special class of rings. As the last result, we present the special class of modules determined by $*_k$.

2010 Mathematics Subject Classification: 16D60, 16S90, 16N60, 16N80.
Keywords: $*-$ring, homomorphic image, special class of rings, special class of modules, prime module.

CT-06. Conjugation action on the family of minimum $\mathscr{D}$-sets of a group

Jose Maria P. Balmaceda[1], Joris N. Buloron*[2]
[1]University of the Philippines Diliman, The Philippines
[2]Mathematics Department, Cebu Normal University, The Philippines
joey@math.upd.edu.ph, jorisbuloron@yahoo.com

Let G be a group. A $\mathscr{D}$-set of G is a subset D with the property that if $x \in G \setminus D$ then $x^{-1} \in D$. This concept was inspired by the theory of dominating

sets of graphs. A *minimum $\mathscr{D}$-set* is a $\mathscr{D}$-set that is minimum under inclusion. We investigate the action of conjugation by a finite group on the set of its minimum $\mathscr{D}$-sets. We show that the kernel of the action is the centralizer $C_G(G\backslash S_G^*)$, where $S_G^* = \{x \in G : x \neq 1, x^2 = 1\}$, and that the action is trivial if and only if G is abelian. In our main result, we prove that that the conjugation action by a finite group is transitive if and only if the group is an elementary abelian 2-group, a dihedral group of order six, or a dihedral group of order eight. In addition, we present several results on the stabilizers and images of the action for some families of groups.

2010 Mathematics Subject Classification: 20B05.
Keywords: finite group, $\mathscr{D}$-set, conjugation, transitive action.

CT-07. The ψ_S polar decomposition when the cosquare of S is normal

Daryl Q. Granario*[1], Dennis I. Merino[2], Agnes T. Paras[3]
[1]Department of Mathematics and Statistics, Auburn University, USA
[2]Department of Mathematics, Southeastern Louisiana University, USA
[3]Institute of Mathematics, University of the Philippines-Diliman, The Philippines
dqg0001@auburn.edu, dmerino@selu.edu, agnes@math.upd.edu.ph

Let $S \in M_n(\mathbb{C})$ be nonsingular. For a nonsingular $A \in M_n(\mathbb{C})$, we set $\psi_S(A) = S^{-1}\overline{A}^{-1}S$. We say that an A is ψ_S orthogonal if $\psi_S(A) = A^{-1}$ and we say that A is ψ_S symmetric if $\psi_S(A) = A$. For a possibly singular $B \in M_n(\mathbb{C})$, we say that B is ψ_S orthogonal if $S^{-1}\overline{B}S = B$. We say that B has a ψ_S polar decomposition if $B = RE$ for some (possibly singular) ψ_S orthogonal R and (necessarily nonsingular) ψ_S symmetric E. If $S = I$, then the ψ_S polar decomposition is the real-coninvolutory decomposition. We show that $A \in M_n(\mathbb{C})$ has a ψ_S polar decomposition if and only if (a) A commutes with $\overline{S}S$, (b) rank A and rank$[(\overline{S}S - \lambda I)A]$ have the same parity for every negative eigenvalue λ of $\overline{S}S$, and (c) the ranges of SA and $\overline{A}$ are the same.

2010 Mathematics Subject Classification: 15A21, 15A23.
Keywords: ψ_S polar decomposition, ψ_S orthogonal matrices, ψ_S symmetric matrices.

CT-08. On graded N-prime submodule of module of fraction of graded module

Sutopo*, Indah Emilia Wijayanti, Sri Wahyuni
Mathematics Department of Universitas Gadjah Mada, Indonesia
{sutopo_mipa, ind.wijayanti, swahyuni}@ugm.ac.id

Let R be any a graded ring with identity. The set $h(R)$ is the set of homogeneous elements of R. A nonempty subset D of $h(R)$ is said to be multiplicatively closed if $st \in D$ wherever $s, t \in D$. If D is a multiplicatively closed subset of $h(R)$, then D is multiplicative system in R if $1 \in D$ and $0 \notin R$. If R is a graded ring and

suppose that $D \subset h(R)$ is a right denominator set in R then RD^{-1} is a graded ring with grading $(RD^{-1})_{(g\in G)}$, $(RD^{-1})_g = \{a/d|a \in h(R), deg(a) - deg(d) = g\}$. Let M be a graded R-module and $h(M)$ is the set of homogeneous element of M. Then MD^{-1} is a graded RD^{-1}-module with grading $(MD^{-1})_{(g\in G)}$, $(MD^{-1})_g = \{m/d|m \in h(M), deg(m) - deg(d) = g\}$. The graded RD^{-1}-module MD^{-1} is called the module of fractions of M with respect to D. In this paper we will define consept of submodule from Sunh in module of fractions of a graded R-module M and furthermore we investigate their characterizations.

2010 Mathematics Subject Classification: 16W50.
Keywords: graded N-prime submodule, fractions of module.

CT-09. On a separation and irreducibility problem of polynomials arising from the nonlinear Schrodinger equation

Bich Van Nguyen
Institute of Mathematics,VAST, Hanoi, Vietnam
nbvan@math.ac.vn

We discuss an algebraic problem which arises from the study of the non-linear Schrödinger equation (NLS for short). This problem is about separation and irreducibility of the characteristic polynomials of the energy graphs of the NLS as polynomials with integer coefficients. For the cubic NLS the problem has been completely solved (by M.Procesi, C.Procesi and B.V.Nguyen, in 2013), meanwhile for higher degree NLS it is still open, even in small dimensions. In this work a partial answer for this problem will be given, in particular, irreducibility and separation of the characteristic polynomials of energy graphs of NLS of arbitrary degree on 1-dimensional torus will be proved.

2010 Mathematics Subject Classification: 15A18, 15A99, 05E99.
Keywords: non-linear Schrödinger equation, characteristic polynomials, graphs, eigenvalue, irreducibility.

CT-10. On quasi and bi-hyper KS-ideals of hyper KS-semigroups

Jocelyn P. Vilela*, Georgie F. Tabaranza
Dept. of Math. and Stat., MSU-Iligan Insitute of Technology, The Philippines
{jocelyn.vilela, georgie.tabaranza}@g.msuiit.edu.ph

This paper introduces and characterizes quasi and bi-hyper KS-ideals of hyper KS-semigroups. Furthermore, this study seeks to find out the decompositions of a decomposable hyper KS-semigroup in the context of quasi and bi-hyper KS-ideals, investigates their respective properties and provides some characterizations. Specifically, for a hyper KS-semigroup H, the following holds:

1. The intersection of a right and left hyper KS-ideal of H is a quasi-hyper KS-ideal of H.

2. Every hyper KS-ideal of H is a quasi-hyper KS-ideal of H.
3. If I is a hyper KS-ideal of H and Q is a quasi-hyper KS-ideal of H, then $I \cap Q$ is a quasi-hyper KS-ideal of H.
4. Let $\{Q_i : i \in I\}$ be a nonempty collection of nonempty subsets of H. Let $\{Q_j : j \in S\}$ and $\{Q_t : t \in I \setminus S\}$ be nonempty families of quasi-hyper KS-ideals and hyper subKS-semigroup of H, respectively. If Q_j is a quasi-hyper KS-ideal for all $j \in S$ and Q_t is a hyper subKS-semigroup when $t \in I \setminus S$, then $\bigcap_{i \in I} Q_i$ is a quasi-hyper KS-ideal of $\bigcap_{t \in I \setminus S} Q_t$.
5. Let H be decomposable with decomposition $H = X \bigoplus Y$, where X and Y are strong hyper KS-ideals of H and $Q \subseteq X$. Then Q is a quasi-hyper KS-ideal of H related to X if and only if Q is a quasi-hyper KS-ideal of H.
6. Let H be decomposable with decomposition $H = X \bigoplus Y$, where X and Y are strong hyper KS-ideals of H and $B \subseteq X$. Then B is a bi-hyper KS-ideal of H related to X if and only if B is a bi-hyper KS-ideal H.

2010 Mathematics Subject Classification: 20N20, 06F35, 08A05.
Keywords: quasi-hyper KS-ideals, bi-hyper KS-ideals, decomposable hyper KS-semigroups.

CT-11. String C-groups of order 2048 and rank 3

Mark L. Loyola*[1], Ma. Louise Antonette N. De Las Peñas[1], Yasushi Gomi[2]
[1]Dept. of Mathematics, Ateneo de Manila University, The Philippines
[2]Dept. of Information and Communication Sciences, Sophia University, Japan
{mdelaspenas,mloyola}@ateneo.edu, y-gomi@sophia.ac.jp

Let $\mathcal{G}$ be a group generated by a set $S = \{s_0, s_1, \ldots, s_{n-1}\}$, $n \geq 1$, of involutions called its *distinguished generators*. The pair $(\mathcal{G}, S)$ is called a *string C-group* with respect to S if

- **String Condition:** its Coxeter diagram $\mathcal{D}(S)$ is a string diagram and
- **Intersection Condition:** for all $J, K \subseteq \{0, 1, \ldots, n-1\}$,

$$\langle s_j \mid j \in J \rangle \cap \langle s_k \mid k \in K \rangle = \langle s_i \mid i \in J \cap K \rangle.$$

Alternatively, a string C-group is the group of automorphisms of a regular abstract polytope. This work determines all string C-groups of order 2048 that are generated by three involutions with a connected string diagram. The groups are determined using the technique of central extension of string C-groups of order 1024 by $\mathbf{Z}_2$. The determination of these groups is facilitated by the use of the computational group theory software GAP.

2010 Mathematics Subject Classification: 20D15, 20F05, 20F65.
Keywords: string C-groups, order 2048, 2-groups, regular abstract polytopes.

CT-12. An intriguing application of telescoping sums

Julius Fergy T. Rabago
Dept. of Mathematics and Computer Science, University of the Philippines Baguio
jfrabago@gmail.com

Difference equations have been of great importance in various fields of mathematics and areas of pure and applied sciences. They frequently appear as discrete mathematical models of various biological and environmental phenomena. Usually, difference equations, especially those that describe ecological events such as predator-prey interactions, are examined due to their rich and complex dynamics. Recently, however, the problem of finding solution forms of some solvable systems of nonlinear difference equations have gained considerable interest from many researchers. Probably, the lack of a general method in dealing with the solution forms of these types of equations make them, perhaps, more interesting and challenging compared to linear types. Nevertheless, numerous studies have dealt with finding solution forms of such type of problems. In most of these works we have seen so far, we observed that the results exhibited therein, particularly the form of solutions of the equation being considered, were established by a mere application of induction principle. We emphasize that this approach can obviously prove or perhaps, we0 should say, "validates" analytically the solution form of a particular system of difference equations. However, it does not give much information on how these formulas are obtained and why their form appear in that way.

As an effort to fill these gaps, we offer in this work a simple yet very intriguing application of telescoping sums in finding closed-form solutions of some solvable systems of nonlinear difference equations. This study, in addition, presents short and elegant approaches in dealing with the solution forms of some particular systems of nonlinear difference equations which have already been studied in previous investigations. We mention that the system of equations which we have examined here are more general compared to those that were recently studied in the literature, and we remark that the technique used here can be applied possibly to other classes of difference equations whose closed-form solutions are, in structure, similar to the ones obtained here – this provides considerable interest to continue investigating similar systems of difference equations.

2010 Mathematics Subject Classification: 39A10.
Keywords: difference equation, telescoping sum, method of differences, solution form.

CT-13. Some properties of derived graph algebras

C. Manyuen*, P. Jampachon, T. Poomsa-Ard
Khon Kaen University, Thailand
schauwat.manyuen@gmail.com, prajam@kku.ac.th, tiang.poom@gmail.com

Let $\underline{A(G)} = (V \cup \{\infty\}; f^A, \infty)$ be graph algebra corresponding to a graph G where f^A is a binary operation. Then $\sigma[\underline{A(G)}] = (V \cup \{\infty\}; \sigma(f)^A, \infty)$ is called

a derived graph algebra, where σ is a regular hypersubstitution. The set of all term equations $s \approx t$ which $\sigma[\underline{A(G)}]$ satisfies denoted by $Id_\sigma(\{G\})$. The class of all derived graph algebras satisfy for all term equations in $Id_\sigma(\{G\})$ is called the **derived graph variety** generated by $\{G\}$ on σ denoted by $\mathcal{V}_\sigma(\{G\})$. A term equation $s \approx t$ is called a **derived identity** in $\mathcal{V}_\sigma(\{G\})$ if $\sigma[\underline{A(G')}]$ satisfies $s \approx t$ for all $\sigma[\underline{A(G')}] \in \mathcal{V}_\sigma(\{G\})$. In this paper we would like to consider some properties and some relation between derived graph algebra and graph algebra.

2010 Mathematics Subject Classification: 05C25, 08B15.
Keywords: varieties, generated graph varieties, terms, identities, binary algebras, graph algebras, hyperidentities, derived algebras.

CT-14. On the bounds of the subset relative degree of a group

Norarida Abd Rhani*[1], Nor Muhainiah Mohd Ali[1], Nor Haniza Sarmin[1]
Ahmad Erfanian[2]
[1]Universiti Teknologi Malaysia, Johor, Malaysia
[2]Ferdowsi University of Mashhad, Mashhad, Iran
arida.ar@gmail.com, {normuhainiah, nhs}@utm.my, erfanian@um.ac.ir

Let G be a group, H any subgroup of G and X any subset of G. The commutativity degree of a finite group G is the probability that a random pair of elements in a group commutes. The concept of commutativity degree has been extended to the relative commutativity degree of a group which is defined as the probability for a random element of subgroup H and a random element of a group G to commute with one another. In this paper, the concept of relative commutativity degree is further extended to the subset relative degree of a group G, which is defined as the probability of a subset X to be a subgroup of a group G. The upper and lower bound for the subset relative degree of a group are presented in two cases, specifically where X is a semi-group and X is a monoid of a group G.

2010 Mathematics Subject Classification: 06F05.
Keywords: commutativity degree, semi-group, monoid.

CT-15. On a generalization of an Abelian ring

Eun-Kyung Cho*, Yang Lee
Department of Mathematics, Pusan National University, South Korea
{ekcho,ylee}@pusan.ac.kr

In this talk, we will introduce a new concept of a noncommutative ring what is called a *quasi-Abelian* ring. The quasi-Abelian ring is a ring that is strictly seated between an Abelian ring and a directly finite ring. Semisimple Artinian rings are quasi-Abelian but not Abelian. This talk will include plentiful of examples and characterizations regarding quasi-Abelian rings. By showing examples, we will see that (1) the concept of a quasi-Abelian ring strictly contains an Abelian ring; (2)

quasi-Abelian rings are not left-right symmetric in general; (3) a directly finite ring strictly contains a quasi-Abelian ring, and so on. And by presenting characterizations, we can construct lots of examples of quasi-Abelian rings. In addition, we will show that for a ring with an involution, the quasi-Abelian property is left-right symmetric.

2010 Mathematics Subject Classification: 16U80, 16S36, 16W10.
Keywords: right quasi-Abelian ring, idempotent, Abelian ring, semisimple Artinian ring, directly finite ring, group of units.

CT-16. On endomorphism rings of max CS and min CS modules

Thuat Van Do*[1], Nguyen Van Sanh[2]
[1]Dept. of Science and Technology, Nguyen Tat Thanh University, Vietnam
[2]Dept. of Mathematics, Faculty of Science, Mahidol University, Thailand
thuat86@gmail.com, nguyen.san@mahidol.ac.th

The class of rings and modules with extending properties (i.e. CS, max CS, min CS, max-min CS) is an important class in ring and module theory. It attracts a lot of interest among ring theorists. In this paper, we investigate modules in this class together with their endomorphism rings. Let R be an associative ring with identity and M be a right $R-$module. We prove that if M is a finitely generated, quasi-projective self-generator, then M is CS (resp. max CS, min CS, max-min CS) module if and only if its endomorphism ring S is a right CS (resp. max CS, min CS, max-min CS) ring. If M is a prime module, then M is nonsingular, max-min CS with a uniform submodule if and only if S is right and left nonsingular, right and left max-min CS with uniform right and left ideals. Moreover, if M is a semiprime, weak duo module, then M is max CS if and only if it is min CS.

2010 Mathematics Subject Classification: 16U80, 16S36, 16W10.
Keywords: right quasi-Abelian ring, idempotent, Abelian ring, semisimple Artinian ring, directly finite ring, group of units.

CT-17. On the cohomological coprimality of Galois representations associated with elliptic curves

Jerome T. Dimabayao
University of the Philippines Diliman, The Philippines
jdimabayao@math.upd.edu.ph

Let E and E' be elliptic curves over an algebraic number field. We show that systems of ℓ-adic representations associated with E and E' are cohomologically coprime, in the sense that the Galois cohomology groups corresponding to respective fields of division points are all trivial. This provides a generalization of some known results about the vanishing of the cohomology groups associated with the ℓ-adic Tate module of an elliptic curve.

2010 Mathematics Subject Classification: 11F80, 11G05.
Keywords: Galois representations, elliptic curves.

CT-18. Skew polynomial ring of a Morita ring of Morita context

Yoshua Yonatan Hamonangan*, Intan Muchtadi-Alamsyah
Algebra Research Group, Institut Teknologi Bandung, Indonesia
yoshua.yonatan.h@gmail.com, ntan@math.itb.ac.id

Let M be a Morita ring of a Morita context and $M[z;\theta,d]$ be a skew polynomial ring over M. By studying a particular ring homomorphism and skew derivation on Morita ring of a Morita context, one can show that $M[z;\theta,d]$ is isomorphic to a particular Morita ring of a Morita context. One compare some properties of M and the $M[z;\theta,d]$ as the consequences of the isomorphism.

2010 Mathematics Subject Classification: 16S36, 16S50
Keywords: Morita context, Morita ring of a Morita context, skew polynomial ring.

CT-19. Construction of cyclic codes over ternary fields using periodic sequences

Azhar Syarifuddin*, Intan Muchtadi-Alamsyah
Algebra Research Group, Institut Teknologi Bandung, Indonesia
azharsyarifuddin@gmail.com, ntan@math.itb.ac.id

Cyclic codes have applications in data storage systems and communication systems as they have efficient encoding and decoding algorithms. This kind of codes can be constructed from minimal polynomials generated by periodic sequences. In this paper we will explain the construction of Cyclic codes over ternary fields inspired by Ding's work in 2013 for binary fields.

2010 Mathematics Subject Classification: 11T71, 94B15.
Keywords: codes, construction, ternary, periodic, sequences.

CT-20. On the p-adic analogue of the Newton-Raphson method for finding the zero of a polynomial

Janus C. Aban*, Julius M. Basilla
University of the Philippines-Diliman, The Philippines
janus.aban@gmail.com, jbasilla@math.upd.edu.ph

Hensel's lemma is a very powerful tool in determining the existence of a root of polynomials contained in $\mathbb{Z}_p[x]$. Basically, it is just the p-adic analog of the Newton-Raphson root-finding algorithm from Numerical Analysis. In this paper, we extend the Hensel's lemma to a bigger class of polynomials over arbitrary complete field $\mathbb{K}$ with non-Archimedean norm induced by principal valuation. In particular for $\mathbb{K} = \mathbb{Q}_p$, the p-adic numbers, we give some type of polynomial which

are covered by the extension of Hensel's lemma. Then for the polynomial of the form $f(x) = x^q - a \in \mathbb{Q}_p[x]$ where q is a natural number, we determine sufficient conditions so that the Newton-Raphson method will apply. For the computational part, we calculate the order of speed convergence of the sequence obtained from the Newton-Raphson iterations converging to a root of $f(x) = x^q - a$. Lastly, we compute the number of iterations needed to obtain a desired number of correct digits in the approximate of qth of a.

2010 Mathematics Subject Classification: 11J61, 11S05, 11Y99.
Keywords: p-adic numbers, Newton-Raphson, p-adic roots.

CT-21. Full identification of idempotents in binary Abelian group rings

Kai Lin Ong*, Miin Huey Ang
Pusat Pengajian Sains Matematik, Universiti Sains Malaysia, Malaysia
i.am.kailin@hotmail.com, mathamh@usm.my

Every code in the latest study of group ring codes is a submodule that has a generator. Study reveals that each of these binary group ring codes can have multiple generators that have diversity algebraic properties. Among the generators, idempotent generators get the most attention as codes with an idempotent generator are easier to determine their minimal distance. We have fully identified all idempotents in every binary cyclic group ring algebraically using basis idempotents. However, the concept of basis idempotent constrained the flexibilities of extending our work into the study of identification of idempotents in non-cyclic groups. In this paper, we extend the concept of basis idempotent into idempotent that has a generator, called a generated idempotent. We show that every idempotent in an abelian group ring is either a generated idempotent or a finite sum of generated idempotents. Lastly, we show a way to algebraically identify all idempotents in every binary Abelian group ring by fully obtain the support of each generated idempotent.

2010 Mathematics Subject Classification: 11T71, 94B99
Keywords: idempotent, generated idempotent, group ring code, binary Abelian group ring.

CT-22. Construction of mathematical weavings in the plane

Aliw-iw Zambrano*, Eden Delight Miro, Agnes Garciano
Ateneo de Manila University, The Philippines
aliwiwirenez@gmail.com, {eprovido, agarciano}eprovido@ateneo.edu

A weaving may be defined as an arrangement of lines in the plane together with a binary relation specifying which line is above the other. The goal of this study is to formulate a methodology to construct weavings from colorings of the plane. Particularly, we present a methodology for systematically constructing weavings of overlapping nets derived from 2-colorings of the plane. The methodology begins

with a 2-coloring of a triangle tiling of the plane by an index 2 subgroup of its corresponding triangle group. From the 2-coloring, we construct two disjoint simple, connected graphs called nets, which constitute what we call an overlapping net. We then construct a weaving on the overlapping net as an interlacement of the two disjoint nets specified by a weaving map. Furthermore, we give a definition of combinatorially equivalent weavings, which leads to a definition of equivalent weavings.

2010 Mathematics Subject Classification: 20H15, 20G99, 05B45, 52C30, 52C20
Keywords: triangle groups, colorings, nets, weavings, weaving equivalence.

CT-23. On representation of polynomial ring on a vector space via a linear transformation

Sri Wahyuni*[1], Indah Emilia Wijayanti[1], Na'imah Hijriati[1,2]
[1]Mathematics Department of Universitas Gadjah Mada, Indonesia
[2]Mathematics Department of Universitas Lambung Mangkurat, Indonesia
{swahyuni, ind.wijayanti}@ugm.ac.id, naimah.hijriati@mail.ugm.ac.id

A representation of ring R is a ring homomorphism from R to $End_F(V)$. Let $\rho\colon R \to End_F(V)$ be a representation of R. A subspace $U \subseteq V$, is said to be admissible submodule, if $\rho_r(U) \subseteq U$ for all $r \in R$. A representation of R is said to be a completely reducible if $V = U_1 \oplus U_2 \oplus ... \oplus U_k$, with U_i is a simple admissible submodule of V, for $i = 1, 2, ...k$. From the field F, we can form $F[X]$ be a polynomial ring. A Representation of $F[X]$ is a homomorphism ring $\rho\colon F[X] \to End_F(V)$, via linear transformation $T\colon V \to V$, such that $\rho(f(X)) = f(T)$ for all $f(X) \in F[X]$. In this paper, we will show that admissible submodules of V are invariant under T, and representation of $F[X]$ is a completely reducible.

2010 Mathematics Subject Classification: 16G60, 13F20.
Keywords: representation ring, polynomial ring, admissible submodule, completely reducible.

CT-24. Lattice structure of weak hyper ks-ideals of a hyper KS-semigroup

Longrio Platil*, Susan Dagondon
MSU-Iligan Institute of Technology, The Philippines
{longrio.platil, susan.dagondon}@g.msuiit.edu.ph

The notion of hyper KS-semigroup was introduced by Vicedo et al. which is a combination of concepts of hyper BCK-algebra and semihypergroups. In this paper, the lattice structure on the class of all weak hyper KS-ideals of a hyper KS-semigroup is studied. We show that the lattice of these ideals form a Boolean and geometric lattice under suitable conditions. Finally, the notion of pseudocomplement is considered and the algebra of all pseudocomplements of weak hyper KS-ideals of a hyper KS-semigroup H is shown to be a Boolean lattice.

2010 Mathematics Subject Classification: 20N20, 06F35, 06B05.

Keywords: geometric lattice, Boolean lattice, weak hyper KS-ideal, hyper KS-semigroup.

CT-25. On some falling fuzzy in BCI-algebras

Alireza Gilani
Department of Mathematics, Faculty of Science, Islamic Azad University, Iran
gilanial@yahoo.com

In the study of a unified treatment of uncertainly medelled by means of combining probability and fuzzy set theory, Goodman(1982) pointed out the equivalence of a fuzzy set and a class of random sets. Wang and Ssnchez introduced the theory of falling shadows which directly relates probability concepts with the membership function of fuzzy sets. Falling shadow representation theory shows us the way of selection relaid on the joint degrees distributions.It is reasonable and convenient approach for the theoretical development and the practical applications of fuzzy sets and fuzzy logics. The mathematical structure of the theory of falling shadows is formulated in Xi (1990). Tan et al. established a theoretical approach to define a fuzzy inference relation and fuzzy set operations based on the theory of falling shadows. Jun and Park (1993) discussed the notion of a falling fuzzy subalgebra ideal of BCK/BCI-algebra. In this paper, we use the theory of falling shadows to establish a falling fuzzy a-ideal of a BCI-algebra as a generalization of a fuzzy a-ideal of in BCI-algebras. We provide relations between falling fuzzy a-ideal and falling fuzzy ideals. We also consider relations between fuzzy a-ideals and falling fuzzy a-ideals. We give conditions for a falling fuzzy ideal to be a falling fuzzy a-ideal.

2010 Mathematics Subject Classification: 06F35, 03B52.
Keywords: BCI-algebras1, a-ideal2, falling fuzzy3.

CT-26. An extension of the commutativity degree of a metacyclic 3-group

Siti Norziahidayu Amzee Zamri*, Nor Haniza Sarmin, Hazzirah Izzati Mat Hassim
Dept. of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia
norzisan@gmail.com, {nhs,hazzirah}@utm.my

Research on commutativity degree has been done by many authors since 1944. The commutativity degree is defined as the probability that a pair of elements in a group G commute. In this research, an extension of the commutativity degree called the probability that an element of a group fixes a set Ω is explored. The group G in our scope is metacyclic 3-group and the set Ω is the subset of all commuting elements in the group, while the group action is conjugation. The probability that an element of G fixes a set Ω is computed using the number of conjugacy classes. The result turns out to depend on the order of Ω.

2010 Mathematics Subject Classification: 20E45, 20P99, 20E99.
Keywords: commutativity degree, metacyclic 3-group, group action, conjugation action.

CT-27. On X-sub-linearly independent modules

Fitriani*[1,2], Budi Surodjo[1], Indah Emilia Wijayanti[1]
[1]Mathematics Department, Universitas Gadjah Mada, Indonesia
[2]Department of Mathematics, Universitas Lampung
fitriani27@mail.ugm.ac.id, {b_surodjo, ind_wijayanti@ugm.ac.id}@ugm.ac.id

The notion of X-sub-exact sequence of modules is a generalization of exact sequences. Let K, L, M be R-modules and X a submodule of L. The triple (K, L, M) is said to be X-sub-exact at L if $K \to X \to M$ is exact at X. The exact sequence is a special case of X-sub-exact by taking $X = L$. We introduce an X-sub-linearly independent module which is a generalization of linearly independent relative to an R-module M by using the concept of X-sub-exact sequence. For any an R-module M, the family of R-modules $\mathcal{N} = \{N_\lambda\}_\Lambda$ is said to be X-sub-linearly independent to M if the triple $(0, \coprod_\Lambda N_\lambda, M)$ is X-sub-exact (where X is a submodule of $\coprod_\Lambda N_\lambda$). If $\sigma(0, \coprod_\Lambda N_\lambda, M)$ is a collection of submodules X of $\coprod_\Lambda N_\lambda$ such that $\mathcal{N}$ is X-sub-linearly independent to M, then we give some basic properties of X-sub-linearly independent modules and $\sigma(0, \coprod_\Lambda N_\lambda, M)$. We proved that $\sigma(0, \coprod_\Lambda N_\lambda, M)$ is closed under submodules and intersections. Furthermore, if $\coprod_\Lambda N_\lambda$ is Noetherian, then $\sigma(0, \coprod_\Lambda N_\lambda, M)$ has a maximal element.

2010 Mathematics Subject Classification: 16D10, 16D60, 16P40.
Keywords: exact sequence, linearly independent module, sub-linearly independent module.

CT-28. Construction of derived category of $U-$complexes

Gustina Elfiyanti*, Intan Muchtadi-Alamsyah, Dellavitha Nasution
Algebra Research Group, Institut Teknologi Bandung, Indonesia
gustina.elfiyanti@uinjkt.ac.id, {ntan,dellavitha}@math.itb.ac.id

The aim of this paper is to define derived category of $U-$complexes. First we prove that the set of all $U-$exact sequences is a null system, then we show that the set of all quasi-isomorphism in the category of $U-$complexes is a multiplicative system. Using those results we construct derived category of $U-$complexes as localization of homotopy category of $U-$complexes with respects to quasi isomorphism of $U-$complexes.

2010 Mathematics Subject Classification: 16E35, 18E30, 18G35.
Keywords: $U-$complexes, null system, multiplicative system, localization of homotopy category, derived category.

CT-29. On representation of a ring on a free modules over a commutative ring with identity

Na'imah Hijriati*[1,2], Sri Wahyuni[2], Indah Emilia Wijayanti[2]
[1]Mathematics Department, Universitas Lambung Mangkurat, Indonesia
[2]Mathematics Department, Universitas Gadjah Mada, Indonesia
naimah.hijriati@mail.ugm.ac.id, {swahyuni, ind.wijayanti}@ugm.ac.id

A Representation of ring R on free module M over commutative ring R' with identity is homomorphism ring $\rho\colon R \to End_{R'}(M)$. If R is a commutative ring with identity and M is a free R-module then we always have a representation of R, that is homomorphism ring $\rho\colon R \to End_R(M)$, with $\rho(r) := \rho_r\colon M \to M$ and $\rho_r(m) = rm$ for all $r \in R$ and for all $m \in M$. Representation of rings on free module over commutative ring with identity is generalization of representation of rings on a vector space over field of complex number. In this paper we will present some properties of representations of ring R on vector space with still work on free R-module. Some of that are relate with admissibility properties of submodule of M. Let M and N be right R-modules, and let $\rho\colon R \to End_R(M)$ and $\varphi\colon R \to End_R(N)$ be two representations of R. The set $Hom_R(\rho, \varphi) = \{T\colon M \to N | T\rho_r = \varphi_r T\}$ is submodule of $Hom_R(M, N)$. Representation of R is completely reducible if M is completely reducible over R. So if R is semisimple, then representation of R is completely reducible.

2010 Mathematics Subject Classification: 16G99,13C10.
Keywords: representation of ring, admissible submodule, completely reducible of representation.

CT-30. A note on hyper GR-algebras

Raymund Indangan, Gaudencio Petalcorin
Mathematical Society of the Philipines, The Philipines
indanganraymund@gmail.com, gaudenciopetalcorin@g.msuiit.edu.ph

The theory of hypercompositional structure has been introduced by F. Marty, in 1934 from the study of several problems of the non-commutative algebra. Moreover, he introduced the concept of hyperstructure theory (also called multialgebras) during the Congress of Scandinavian Mathematician and defined hypergroups based on the concept of a hyperoperation which is a generalization of a binary operation in algebra, and did the analysis on the application of its properties to groups. Algebraic hyperstructure was a suitable generalization of classical algebraic hyperstructure, that is, in a classical algebraic structure, the composition of two elements is an element, while the composition of two elements is a set of elements in an algebraic hyperstructure. In 2006, X.X.Long applied the concept of hyperstructure theory in BCI-algebra and proved that hyper BCI-algebras are one of the generalizations of BCI-algebras. Besides BCI-algebras are one of the generalizations of BCK-algebras. This paper introduces a new concept of hyperstructure which is

different from the existing hyper BCI-algebras as studied by X.X. Long. Consider a hyperalgebra $H = \{0, 1, 2\}$ defined by the following Cayley's table

$\circledast$	0	1	2
0	$\{0\}$	$\{0\}$	$\{0\}$
1	$\{0, 1, 2\}$	$\{0, 1\}$	$\{0, 1\}$
2	$\{0, 2\}$	$\{0, 1, 2\}$	$\{0, 2\}$

Then by routine calculations, we see that $(H; \circledast, 0)$ is not a hyper BCI-algebra since it violates the condition of a hyper BCI-algebra $(HBCI_4) : x \ll y$ and $y \ll x$ implies that $x = y$, that is, if $x = 0$ and $y = 1$, we have $0 \ll 1$ and $1 \ll 0$ but $1 \neq 0$. However, it satisfies the condition $[(x \circledast y) \circledast z] \ll (y \circledast z)$. This motivates the researchers to introduce a new hyperstructure called hyper GR-algebra.

2010 Mathematics Subject Classification: 06F35.

Keywords: algebraic hyperstructure, hyper BCI-algebras, hyper BCK-algebras, hyper GR-algebras.

CT-31. On almost prime submodules of a finitely generated primary module over a principal ideal domain

I Gede Adhitya Wisnu Wardhana*, Pudji Astuti, Intan Muchtadi-Alamsyah
Algebra Research Group, Institut Teknologi Bandung, Indonesia
aditmath@s.itb.ac.id, {pudji,ntan}@math.itb.ac.id

Khashan's study concerning a characterization of almost prime submodules was restricted to multiplicative modules. In this paper, we give a characterization of almost prime submodules of a finitely generated primary module over a principal ideal domain. The characterization obtained by employing the cyclic decomposition theorem and properties of regular submodules of finitely generated primary module.

2010 Mathematics Subject Classification: 16D70, 16S50.

Keywords: almost prime submodule, primary module, prime submodule, principal ideal domain.

CT-32. A note on even almost perfect numbers and related numbers

Keneth Adrian P. Dagal
Far Eastern University, The Philippines
kdagal@feu.edu.ph

A positive integer N is called perfect, quasiperfect (QP), or almost perfect (AP) if $\sigma(n) = \sum_{d|n} d$ is $2n$, $2n+1$, and $2n-1$ respectively. In this paper, we will provide some new results and extensions about these kind of numbers. We will use the function, the abundancy of N, denoted by $A(n)$, and defined as $A(n) = \sigma(n) - 2n$. In addition, we will extend a particular criterion of Dagal and Dris on almost perfect numbers, and we will also include some related new propositions about related numbers like solitary, friendly, deficient, abundant, and k-perfect.

2010 Mathematics Subject Classification: 11A25.

Keywords: *odd perfect numbers, solitary numbers, almost perfect numbers.*

CT-33. On right chain ordered semigroups

Panuwat Luangchaisri*, Thawhat Changphas
Khon Kaen University
desparadoskku@hotmail.com, thacha@kku.ac.th

An ordered semigroup with the set of all right ideals froms a chain by inclusion is called a right chain ordered semigroup. In this paper we study the ideal theory of a right chain ordered semigroup in terms of prime and completely prime ideals. The results obtained generalize the results of Ferrero, Mazurek and Ana [M. Ferrero, R. Mazurek, A. S. Ana, On right chain semigroups, J. of Algebra 292 (2005), 574-584].

2010 Mathematics Subject Classification: 06F05.
Keywords: right chain ordered semigroup, prime ideal, completely prime ideal, semiprime ideal, completely semiprime ideal, Archimedean, prime segment.

CT-34. On the ideal class group of monogenic cubic fields

Eric Anthony C. Arances*, Julius M. Basilla
University of the Philippines
{eaarances, jbasilla}@math.upd.edu.ph

Let $K = \mathbb{Q}(\theta)$ be a cubic field where θ is a root of the irreducible polynomial $x^3 + mx + n \in \mathbb{Z}[x]$. Let $\mathfrak{O}_K$ be its ring of integers such that $\mathfrak{O}_K = \mathbb{Z} + \mathbb{Z}\theta + \mathbb{Z}\theta^2$. The unique factorization of elements of $\mathfrak{O}_K$ is determined by the ideal class group H_K of K, i.e. $\mathfrak{O}_K$ is a unique factorization domain if and only if H_K is trivial. A result of Minkowski tells us that it is enough to work with the ideal classes of $\mathfrak{p}_p$, where $\mathfrak{p}_p$ is a prime ideal factor of the principal ideal (p), and $p \in \mathbb{Z}$ is prime such that $p \leq M_K$, the Minkowski bound. The factorization of (p) is determined by the factorization of $x^3 + mx + n \pmod p$. However, some prime ideal factors may belong to the same ideal class. Hence, we determine which of these prime ideals depend on others to obtain a linearly independent generating set for H_K. For quadratic fields, T. Ono represented the prime ideals of $\mathfrak{O}_K$ by $\mathbb{Z}$-modules. And for the dependence relations among the prime ideals, Ono considered the factorization of the principal ideal $(r + \theta)$, which is the identity in the ideal class sense, for all r such that the rational prime factors of $N(r + \theta)$ are all less than or equal to M_K. We extend Ono's results to cubic fields.

2010 Mathematics Subject Classification: 11R29, 11R16.
Keywords: cubic field, class number, ideal class group, Minkowski.

CT-35. Essential domains and Prüfer v-multiplication domains: recent developments

Marco Fontana
Università degli Studi "Roma Tre", Italy
fontana@mat.uniroma3.it

This talk is partially based on a joint work with S. El Baghdadi and M. Zafrullah.

It is well known that a Prüfer v-multiplication domain (for short, PvMD) is an essential domain, since each localization at its t-prime ideals is a valuation domain. M. Griffin in 1967 gave a very simple characterization of PvMDs in case of integral domains with the t-finite character (i.e., satisfying the property that each nonzero element is contained in finitely many t-maximal ideals). In this case, they are exactly the essential domains with the t-finite character. However, in general, an essential domain is not necessarily a PvMD. A very illuminating example was given by Heinzer-Ohm in 1973. In 2015, Finocchiaro-Tartarone have gone through this construction and one of the main results of their paper describes the class of PvMDs precisely as a subclass of essential domains verifying an additional "topological" condition, regarding ultrafilter limits of suitable families of prime ideals. In this talk, I will discuss a different and purely algebraic approach for characterizing PvMDs in the class of essential domains.

2010 Mathematics Subject Classification: 13F05, 13G05, 13B30, 13E99.
Keywords: divisorial or v-ideal, t-ideal, Prüfer domain, essential domain, invertible ideal, spectral space, constructible or patch topology.

CT-36. Invertiblity of some circulant matrices

Bustomi, Aleams Barra
Algebra Research Group, Institut Teknologi Bandung, Indonesia
bustomi@students.itb.ac.id, barra@math.itb.ac.id

Circulant matrices have many connections to many branches in mathematics including but not limited to coding theory, image processing, numerical analysis, number theory, geometry and differential equation. One of the important problem is to determine the invertibility of circulant matrices. Carmona(2015) in her paper gave the necessary and sufficient condition for some special circulant matrices, that are matrices of the form $\mathrm{Cir}(a, b, c, ..., c)$ and $\mathrm{Cir}(a, b, c, ..., c, a)$ where a, b and c are real numbers. In this paper, we will give a new proof of some results in the paper of Carmona and generalize her result to include circulant matrices of the similar type where a and b are in arbitrary position.

2010 Mathematics Subject Classification: 11T71, 15A09 ,15A150.
Keywords: circulant matrices, polynomial representation, minimal polynomial, root of unity.

CT-37. Implementation of pollard rho over binary fields using brent cycle detection algorithm

Intan Muchtadi-Alamsyah*, Taufiq Akbari Utomo
Faculty of Mathematics and Natural Sciences, Institut Teknologi Bandung
ntan@math.itb.ac.id, taufiqakbariutomo@yahoo.co.id

The security of Elliptic Curve Cryptography depends on how to solve the Elliptic Curve Cryptography Discrete Logarithm Problem (ECDLP). In this paper we propose the use of modified Pollard Rho Algorithm by using Brent Cycle Detection Algorithm to solve the ECDLP. We give performance comparison on time and the number of iterations between Pollard Rho with Brent Cycle Detection and Pollard Rho with Negation map. In particular, for Koblitz curve, we also give comparison between Pollard Rho with Brent Cycle Detection and Pollard Rho with Negation and Frobenius maps.

2010 Mathematics Subject Classification: 11T71.
Keywords: elliptic curve cryptography, Pollard Rho Algorithm, Brent Cycle Detection, Frobenius map.

CT-38. The use of wallpaper-group in the development of Malay songket motif design

Riza Agustiani
Universitas Islam Negeri Raden Fatah, Indonesia
riza.mathedu@gmail.com

Malay Islamic Studies cover all study of the development of Islam on the islands of Sumatra, Kalimantan, and Sulawesi. In the field of Mathematics Education, Malay culture is one of contexts that can be used in teaching mathematics. One of the topics that can use the context is group theory in course of Algebraic Structure. In this study, Malay culture that is studied is the songket motif designs. The materials group theory that is related to the songket motif designs is wallpaper-group. Wallpaper-group is symmetry group with composition operation. In this study, the researcher apllied two steps. The first step, the three existing songket motif designs that is examined to determine unit cell and type of wallpaper-group. Based on the first step result, the new songket motif designs are developed from Malay Islamic symbols or ornaments using wallpaper-group. The development of new songket motif designs used some applications, such as Tess 1.7.5 and Kali 5.3.3. In conducting the study and developing the songket motifs design, the researcher engaged Malay culture experts and Songket experts to gain information and justification of the result of the study and the results of the songket motif designs development. The data collection techniques are literature study, observation, and interviews. The result of the study can be used as a new reference for Malay studies and the context of the group theory of the course of Algebra Structure.

2010 Mathematics Subject Classification: 97H40, 20B30.

Keywords: algebraic structures, Malay, motif kain songket weaving, wallpaper-group.

CT-39. The U-extension module

Yudi Mahatma*[1,2], Intan Muchtadi-Alamsyah[2]
[1]Universitas Negeri Jakarta, Indonesia
[2]Algebra Research Group, Institut Teknologi Bandung, Indonesia
yudi_mahatma@unj.ac.id, ntan@math.itb.ac.id

Given any R-module M there always exists the U-projective resolution of M for any R-submodule U of M. This resolution is unique up to U-homotopy and in case U is the zero submodule, the resolution is the ordinary projective resolution. The U-projective resolution generates the U-extension module of M as the ordinary projective resolution generates the ordinary extension module of M. The U-extension module of M is unique up to isomorphism for every choice of the U-projective resolution. This module induces a generalization of Ext functor.

2010 Mathematics Subject Classification: 16E05, 16E30, 18G99.
Keywords: U-projective resolution, U-homotopy, U-extension module, Ext functor.

CT-40. Max plus algebra and petri net application on scheduling of ship engine component′S spare part ordering

Farah Azizah*, Subiono
Institut Teknologi Sepuluh November, Indonesia
farahazizah19@yahoo.co.id, subiono2008@matematika.its.ac.id

Shipping company is a company that runs its business by operating the ships or other businesses that are closely related to the ship. A ship has a main engine and some auxiliary engines to support the ship performance. It needs to do maintenance of engines so that the ship can operate properly. This engine maintenance is replacement of the old engine components with the new ones if the running hour of the components is over. Therefore, in the ship must always be available at least one spare part of each engine component. During this time, the company has experienced a difficulty in determining the time of spare part ordering. When the running hour of engine components is over, the spare parts were not yet available. Then, Petri Net and Algebra Max Plus model will be built to schedule the ordering of ship engine component's spare part based on the ordering flow and the running hour of engine components. It is expected that the spare part of each ship engine component is always available so that the installation can be timely.

2010 Mathematics Subject Classification: 15-xx, 15Axx, 15A80.
Keywords: ordering sheduling, spare part, running hour, max plus algebra, petri net.

CT-41. On Euclidean and Hermitian self-dual cyclic codes over $\mathbb{F}_{2^r}$

Odessa Consorte*, Valdez Lilibeth
Institute of Mathematics, University of the Philippines Diliman, The Philippines
{oconsorte,ldicuangco}@ math.upd.edu.ph

Cyclic and self-dual codes are important classes of codes in coding theory. Jia, Ling and Xing ("On Self-Dual Cyclic Codes Over Finite Fields," *IEEE Transactions on Information Theory*, April 2011) as well as Kai and Zhu ("On Cyclic Self-Dual Codes," *AAECC*, vol. 19, 2008.) proved that Euclidean self-dual cyclic codes of length n over $\mathbb{F}_q$ exist if and only if n is even and $q = 2^r$, where r is any positive integer. For n and q even, there always exists an $[n, \frac{n}{2}]$ self-dual cyclic code with generator polynomial $x^{\frac{n}{2}} + 1$ called the *trivial self-dual cyclic code*. In this paper we will use the splitting of $\mathbb{Z}_{\overline{n}}$ to prove the existence of self-dual cyclic codes over $\mathbb{F}_{2^r}$. For n, q relatively prime, a *splitting* of $\mathbb{Z}_{\overline{n}}$ by the multiplier $\mu_b, b \neq 0$ is a triple (Z, X_0, X_1) such that Z, X_0, X_1 are unions of q-cyclotomic cosets mod $\overline{n}$ where $\mathbb{Z}_{\overline{n}} = Z \cup X_0 \cup X_1$ and $Z \cap X_0 \cap X_1 = \emptyset$; and $\mu_b(Z) = Z, \mu_b(X_0) = X_1, \mu_b(X_1) = X_0$. We shall prove that nontrivial self-dual cyclic codes of length $n = 2^\nu \cdot \overline{n}$ ($\overline{n}$ odd, $\nu > 0$) over $\mathbb{F}_{2^r}$ exist if and only if there exists a nontrivial splitting (Z, X_0, X_1) of $\mathbb{Z}_{\overline{n}}$ by μ_{-1}, and each 2^r-cyclotomic coset in Z is fixed setwise by μ_{-1}. We then express the formula for the number of cyclic self-dual codes over $\mathbb{F}_{2^r}$ for each n and r in terms of the number of 2^r-cyclotomic cosets in X_0 (or in X_1). In addition, we show that non-trivial self-dual cyclic codes of length $n = 2^\nu \overline{n}$ over $\mathbb{F}_{2^r}$ exist if and only if $2^{rk} \not\equiv -1 \pmod{\overline{n}}$ for all positive integers k.

We also look at Hermitian self-dual cyclic codes and show properties which are analogous to those of Euclidean self-dual cyclic codes by again looking at cyclotomic cosets and the splitting of $\mathbb{Z}_{\overline{n}}$. We will prove the existence of nontrivial Hermitian self-dual codes of length $n = 2^\nu \cdot \overline{n}$ ($\overline{n}$ odd, $\nu > 0$), over $\mathbb{F}_{2^{2\ell}}$ based on the existence of a nontrivial splitting (Z, X_0, X_1) of $\mathbb{Z}_{\overline{n}}$ by μ_{-2^ℓ}, where Z, X_0, X_1 are unions of $2^{2\ell}$-cyclotomic cosets mod $\overline{n}$. Moreover, we shall give the formula for the number of Hermitian self-dual cyclic codes given n and ℓ in terms of the number of $2^{2\ell}$-cyclotomic cosets in X_0 (or in X_1). We also prove that nontrivial Hermitian self-dual cyclic codes of length $n = 2^\nu \overline{n}$ over $\mathbb{F}_{2^{2\ell}}$ exist if and only if $2^{\ell(2k+1)} \not\equiv -1 \pmod{\overline{n}}$ for all positive integers k.

2010 Mathematics Subject Classification: 94B15.
Keywords: cyclic codes, self-dual codes, splittings.

CT-42. Rational digit expansions of formal Laurent series over finite fields

Manuel Joseph C. Loquias*[1], Mohamed Mkaouar[2], Klaus Scheicher[3]
Jörg M. Thuswaldner[4]
[1]Institute of Mathematics, University of the Philippines Diliman, The Philippines
[2]Faculté des Sciences de Sfax, Tunisia
[3]Institute for Math., Univ. of Natural Resources and Applied Life Sciences, Austria
[4]Department of Mathematics and Statistics, University of Leoben, Austria
mjcloquias@math.upd.edu.ph, mohamed.mkaouar@fss.rnu.tn, klaus.scheicher@boku.ac.at, joerg.thuswaldner@unileoben.ac.at

Digit systems over finite fields have been first studied by Kovács and Pethő [*Acta Sci. Math. (Szeged)*, **55**, 287 (1991)]. Since then they have been generalized in various ways and many of their properties have been investigated. Although they often behave similar to their "cousins" defined over $\mathbb{Z}$ and $\mathbb{R}$, they also show completely different properties that have no analogue in the integer case. Here, we investigate digit systems with "rational bases" defined in rings of polynomials and fields of formal Laurent series over finite fields. The specialty of these digit systems consists in the fact that they have rational functions as bases and, hence, form the analogues of the rational based digit systems of real numbers studied by Akiyama *et al.* [*Israel J. Math.*, **168**, 53 (2008)]. To be more precise, let P and Q be two nonzero coprime polynomials over the finite field $\mathbb{F}_q$ with $\deg P > \deg Q$, and let $\mathcal{D} = \{s \in \mathbb{F}_q[X] : \deg s < \deg P\}$. Then by a simple algorithm each polynomial w over $\mathbb{F}_q$ has a *P/Q-polynomial digit expansion* given by $w = \sum_{i=0}^{k} \frac{s_i}{Q} \left(\frac{P}{Q}\right)^i$ with "digits" $s_i \in \mathcal{D}$. Just as in the integer setting, an expansion tree may be set up that characterizes all possible P/Q-polynomial digit expansions. By means of the infinite strings in the expansion tree, P/Q-digit expansions can also be defined for formal Laurent series over $\mathbb{F}_q$. We prove uniqueness and automatic properties of these expansions. Finally, we study relations between digit expansions of formal Laurent series and a finite fields version of Mahler's 3/2-problem.

2010 Mathematics Subject Classification: 11A63,11T55,11B85.
Keywords: digit system, finite fields, formal Laurent series, Mahler's 3/2-problem.

CT-43. On associated prime of fraction submodules over arbritrary ring

Uha Isnaini*, Indah Emilia Wijayanti
Mathematics Department of Universitas Gadjah Mada, Indonesia
isnainiuha@ugm.ac.id, {ind.wijayanti, swahyuni}@ugm.ac.id

Given a unity ring R, a right-module M_R and a right denominaotr set $S \subset R$. We can construct a right fraction ring $Q = RS^{(} - 1)$ and a right module Q over $MS^{(} - 1)$. If N_R is a submodule in M_R and $Ass(N_R)$ then we can construct $Ass(NS_R^{(}-1))$ and $Ass(NS_Q^{(}-1))$. In this paper, we will discuss the form and some properties of associated primes over fraction modules such as: The Characterization

of associated prime on fraction module, the relationship between associated prime over fraction modules and the modules, some properties of associated primes when R is a right Noetherian ring, the relationship between associated primes and the set of zero divisor of Q and the formula for associated primes on the direct sum and Cartesian product over the same ring.

2010 Mathematics Subject Classification: 06F25.

Keywords: associated prime, right fraction modules, prime modules.

CT-44. An application of IFP ring into module theory

Hai Hoang Dinh*, Hien Truong Thi
Hong Duc University, Vietnam
{hoangdinhhai, truongthihien}@hdu.edu.vn

In this study, the ring R is associative with identity and all module M are unitary right R-modules. A right (or left) ideal I of a ring R is said to have the *insertion-of-factors-property* (or simply *IFP*) if $ab \in I$ implies $aRb \subset I$ for $a, b \in R$. A ring R is called *IFP* if the zero ideal of R has the IFP. A ring R is called semicommutative if for every $a \in R$, the set of right anihilator element of a is an ideal of R. That means for every $a, b \in R$,$ab = 0$ implies $aRb = 0$. In 2007, N.Agayer,A.Harmanci called a right R- module M to be a semicommutative module if for any $m \in M$, any element $a \in R$, $ma = 0$ then $mRa = 0$. A right R- module M is called S-semicommutative module if for any endomorphism φ of M, any element m and if $\varphi(m) = 0$, then $\varphi S(m) = 0$. As a result of recasting IFP rings, a submodule N of M is called to satisfy a "generalization of insertion of factor property" if for any endomorphism $\varphi \in S := End_R(M)$ and $m \notin N$, if $\varphi(m) \in N$, then there is $m' \notin N$ such that $\varphi S(m') \subseteq N$. And then N is called an g-IFP submodule of M. A right R-module M is called g-IFP module if 0 is an g-IFP submodule of M. In this paper, we investigate basic properties and relationships between g-IFP modules and their endomorphism rings. Several known results are recast as the application of g-IFP rings and then S-semicommutative modules can be obtained again.

2010 Mathematics Subject Classification: 16D50, 16D70, 16D80.

Keywords: IFP rings, g-IFP rings, semicommutative, S-semicommutative modules, g-IFP modules.

CT-45. Quotient structure and homomorphic properties of $S\Gamma$-semimodules over $S\Gamma$-semirings

Shirley Mae A. Galindo*[1], Jr. Gaudencio C. Petalcorin[2,3]
[1]Department of Mathematics, Central Mindanao University, The Philippines
[2]Department of Mathematics and Statistics, Mindanao State University
[3]Iligan Institute of Technology, Iligan City, The Philippines
shirleymaegalindo@yahoo.com, gaudencio.petalcorin@g.msuiit.edu.ph

The concept of a Gamma ring was introduced by Nobusawa as a generalization of rings and ternary semirings. Rao generalized Gamma rings, with his study on Gamma semirings. A structure over Gamma rings, called Gamma modules was developed by Ameri and Sadeghi. Sardar and Dasgupta then introduced Gamma semimodules, a module-like structure over Gamma semirings and provided preliminary results and properties. This paper introduces the concept of partitioning $S\Gamma$-subsemimodules and subtractive $S\Gamma$-subsemimodules and are employed in constructing a quotient structure in $S\Gamma$-semimodules. Furthermore, isomorphism theorems on $S\Gamma$-semimodules and other important results are established using partitioning $S\Gamma$-subsemimodules.

2010 Mathematics Subject Classification: 16D80, 16Y60, 06B23.
Keywords: Gamma-semiring, Gamma-semimodule, partitioning subsemimodule, subtractive subsemimodule, quotient structure, isomorphism theorem.

CT-46. On Rees algebras of linearly presented ideals: an approach via local cohomology

Nguyen P. H. Lan
College of Science, Vietnam National University, Vietnam
lannph@vnu.edu.vn

Let I be a height two perfect ideal with a linear presentation matrix in a polynomial ring $R = k[x_1, \ldots, x_d]$. Assume that $\mu(I) = d + 1$ and I satisfies the Artin-Nagata condition G_{d-1}. We determine the defining ideal of the Rees algebra $\mathcal{R}(I)$ explicitly and we show that $\mathcal{R}(I)$ is Cohen-Macaulay. In 2014, we already approached this problem via linkage theory. In this talk, we will introduce another approach using local cohomology.

2010 Mathematics Subject Classification: 13A30, 13H10, 13C14.
Keywords: Cohen-Macaulay ring, Jacobian dual, symmetric algebra, Rees algebra.

Poster Sessions

P-01. On (m, n)-ideals and (m, n)-regular ordered semigroups

Limpapat Bussaban, Thawhat Changphas
Department of Mathematics, Faculty of Science, Khon Kaen University, Thailand
im.bussaban@gmail.com, thacha@kku.ac.th

Let m, n be non-negative integers. A subsemigroup A of an ordered semigroup $(S, \cdot, \leq)$ is called an (m, n)-ideal of S if (i) $A^m S A^n \subseteq A$, and (ii) if $x \in A$, $y \in S$ such that $y \leq x$, then $y \in A$. In this paper, necessary and sufficient conditions for every (m, n)-ideal (resp. (m, n)-quasi-ideal) of an (m, n)-ideal (resp. (m, n)-quasi-ideal) A of S is an (m, n)-ideal (resp. (m, n)-quasi-ideal) of S will be given. Moreover, (m, n)-regularity of S will be discussed. The results obtained extend the results on semigroups (without order) studied by Bogdanović (1979).

2010 Mathematics Subject Classification: 06F05.
Keywords: ordered semigroup, (m, n)-ideal, (m, n)-quasi-ideal, regularity.

P-02. Algebraic properties of the multistate population matrix model

Ema Carnia*, Sisilia Sylviani, A. K. Supriatna
Department of Mathematics, Universitas Padjadjaran
{ema.carnia, sisilia.sylviani, a.k.supriatna@unpad.ac.id}

Discrete time population growth is often modeled by a matrix. Many growth parameters such as growth rate, reproduction rate, as well as the movement of the population are easily included in a matrix model. This paper will discuss a matrix model that describes the dynamics of a population having some stages of life and occupying some different patches. The matrix, which is the product of two matrices S and D, is often called an SD matrix. The matrix S is a diagonal block matrix in which its block is a sub-stochastic column matrix. The matrix describes the movement of a population between patches. On the other hand, the matrix D is a block matrix in which its block is a diagonal matrix with nonnegative real entries. The matrix D describes the population growth in specific patches. The paper will focus on the properties of the SD matrix from the algebraic point of view, particularly the spectral radius of the matrix. Among the results it can be shown that the spectral radius of the SD matrix is less than the spectral radius of D matrix.

2010 Mathematics Subject Classification: 15B51.
Keywords: matrix model, spectral radius, sub-stochastic matrix.

P-03. An algebraic study of the matrix meta-population model

Sisilia Sylviani*, Ema Carnia, A. K. Supriatna
Department of Mathematics, Universitas Padjadjaran
{sisilia.sylviani, ema.carnia, a.k.supriatna@unpad.ac.id}

In studying the population living in some patches, a single patch model usually generalizes into a meta-population model. Roughly speaking a meta-population is population consisting of some sub-populations, such as sub-population reflecting different life stages of the population or different habitat of patches. In a meta-population framework the dynamics of population within and between patches can be easily studied. This paper will discuss the matrix meta-population model that describes the movement of population between patches denoted by F. The matrix F is a blocks matrix that the block in the form of a diagonal matrix with nonnegative real entries. The matrix is obtained by multiplying three matrices; the transpose of a permutation matrix, a block diagonal matrix that its diagonal blocks is matrix A(j), and the permutation matrix. The matrix A(j) is the real non-negative matrix that represents the dynamics of population growth in the patch j. The permutation matrix has a special form that has properties that are more specific than the general permutation matrix. This will provide a space for exploring the characterization of the matrix F from algebraic point of view.

2010 Mathematics Subject Classification: 15B99.
Keywords: matrix permutation, meta-population model, population growth matrix.

P-04. Ordered semigroups containing covered one-sided ideals

Thawhat Changphas, Pisan Summaprab*
Khon Kaen University
thacha@kku.ac.th, pisansu9999@gmail.com

In this paper, we introduce the notion of covered one-sided ideals of ordered semigroups and study the structure of ordered semigroups containing covered one-sided ideals.

2010 Mathematics Subject Classification: 60F05.
Keywords: semigroup, ordered semigroup, left ideal, right base, maximal left ideal, covered left ideal.

P-05. A key exchange protocol using matrices over group rings

Ari Dwi Hartanto
ari.d.hartanto@gmail.com

A simplest key exchange protocol was originally introduced by Diffie and Hellman. They constructed the protocol based on multiplication group $\mathbb{Z}_p^*$, where p is a prime number. One of disadvantages on this system is that the computation of

g^a and reducing the result modulo p are not efficient for the large integer a and p. In this paper, we discuss an alternative way to handle this problem. Our idea is to modify the system by replacing base of system $\mathbb{Z}_p^*$ with a group ring. As a result, we will show that the new system will be more efficient in computation.

2010 Mathematics Subject Classification: 11T71, 14G50, 94A60.
Keywords: cryptography, key exchange protocol, group rings, secret key.

P-06. Matrix methods for bi-periodic Fibonacci and Lucas sequences

Joy P. Ascaño*, Edna N. Gueco
University of the Philippines Baguio, The Philippines
{jpascano, engueco}@up.edu.ph

This paper investigates interesting characteristics of certain generalization of the Fibonacci and Lucas sequences. In view of the works of Demirtürk (2010) on the classical Fibonacci and Lucas sequences, the Q-matrix analogue are formulated and utilized to derive various properties of the bi-periodic Fibonacci and Lucas sequences recently introduced by Edson et al (2009) and Bilgici (2014), respectively. Furthermore, this research provides alternative approach for some of the identities found in the aforementioned literature including the Binet's formula for these two sequences. Other new properties such as summation identities are also established through matrix methods.

2010 Mathematics Subject Classification: 11B37, 11B39, 40C05.
Keywords: bi-periodic Fibonacci sequence, bi-periodic Lucas sequence, Q-matrix.

P-07. A continuous linear representation from topological quotient group into topological quotient vector space

Diah Junia Eksi Palupi
Mathematics Department of Universitas Gadjah Mada, Indonesia
diah_yunia@ugm.ac.id

Let a continuous linear representation from a topological group into a topological vector space. By that representation, we have a topological quotient group. In this paper, if that topological vector space have a topological subspace where its invariant over the continuous linear representation, we prove there is a topological quotient vector space such that there is a continuous linear representation from topological quotient group into topological quotient vector space.

2010 Mathematics Subject Classification: 54H11, 22A25.
Keywords: topological group, topological vector space, continuous linear representation, invariant over a representation.

P-08. Euclidean quadratic fields with discriminant between 500 and 1200

Vonn Kee G. Wong*, Julius M. Basilla
University of the Philippines Diliman, The Philippines
{vkwong, jbasilla}@math.upd.edu.ph

Let $K = \mathbb{Q}(\sqrt{m})$ with $m > 0$, a squarefree integer. Further assume that its ring of integers $\mathcal{O}_K$ is a principal ideal domain. One key fact is that every Euclidean domain, an integral domain with a Euclidean algorithm, is a principal ideal domain. Malcolm Harper introduced a way of determining whether $\mathcal{O}_K$ is a Euclidean domain or not without constructing a Euclidean algorithm. He used the notion of admissible primes in $\mathcal{O}_K$ and the existence of two admissible primes guarantees the existence of a Euclidean algorithm in K. To determine if there exist two admissible primes in $\mathcal{O}_K$, it is enough to find two rational odd primes that splits in K satisfying certain properties and these two rational odd primes serve as norms for the admissible primes. Recall that a prime p splits in K if the Kronecker symbol $\left(\frac{\Delta_K}{p}\right) = 1$, where Δ_K is the discriminant of K. We search these rational primes using Magma. In this paper, we restrict our case to real quadratic fields of discriminant between 500 and 1200 with class number one and we show the existence of two admissible primes in each of these fields which guarantees their Euclideanity.

2010 Mathematics Subject Classification: 11A05.
Keywords: euclidean algorithm, admissible primes, real quadratic field

P-09. Linear transformation and isomorphism over max-plus algebra

M. Imran, Amir Kamal Amir, Nur Erawaty
Universitas Hasanuddin, Indonesia
muh.imran716@gmail.com, {amirkamalamir, nurerawaty}@yahoo.com

Max-plus algebra is one of the concepts in algebraic structures. Max-plus algebra is the set $R \cup \{-\infty\}$ with max and + as the two binary operations which forms a commutative idempotent semi-field. In this paper we systematically revisit classical algebraic structures used in conventional algebra and we substitute the commutative idempotent semi-field max-plus algebra for the field of scalars. The purpose is to provide the mathematical tools need to study linear transformation and isomorphism in commutative idempotent semi-modules over max-plus algebra. Many researchers have worked on max-plus algebra. Among of them discuss about semi-modules n-dimentional max-plus algebra, vectors, matrices and linear systems of equations. So, we will use their results to define general semi-modules over max-plus algebra, further to identify the properties of linear transformation and isomorphism over max-plus algebra.

2010 Mathematics Subject Classification: 15A80.
Keywords: max-plus algebra, linear transformation, isomorphism.

P-10. Characteristic of $B1$ near-ring and $S1$ near-ring

Maulana Akbar, Nikken Prima Puspitar
Universitas Diponegoro, Indonesia
mauladds@gmail.com, nikkenprima@yahoo.com

Let N be a non empty set with two binary operations additive and multiplicative is called near-ring if N over additive operation is group (not necessarily abelian), N over multiplicative operation is semigroup, and N over both binary operation satisfies right (left) distributive law. Near-ring $(N, +, \bullet)$ is called S_1 near-ring if for every $a \in N$, there exist $x \in N^*$, $axa = xa$. Near-ring $(N, +, \bullet)$ is called strong S_1 near-ring if for every $a \in N$, $axa = xa$, for every $x \in N^*$. Near-ring N is called Boolean near-ring if for every $a \in N$, $N(aa) = Na$. Near-ring N is called B_1 near-ring if for every $a \in N$, there exist $x \in N^*$, $Nxa = Nax$. Near-ring N is called strong B_1 near-ring if for every $a, b \in N$, $Nba = Nab$. In this undergraduated thesis we discussed some of their properties, obtain a characterisation and also a structure theorem beetwen strong S_1 near-ring and B_1 near-ring, Boolean near-ring and B_1 near-ring, B_1 near-ring and strong B_1 near-ring.

2010 Mathematics Subject Classification: 16Y30.
Keywords:S_1 near-ring, strong S_1 near-ring, Boolean near-ring, B_1 near-ring strong, B_1 near-ring.

P-11. Identity based encryption using weil pairing

Najib Mubarok*, Sri Wahyuni
Mathematics Department of Universitas Gadjah Mada, Indonesia
najib.mubarok28@gmail.com, swahyuni@ugm.ac.id

Given elliptic curve $E : y^2 = x^3 + ax + b$ over finite field $\mathbb{F}_p$ with $char(\mathbb{F}_p) \notin \{2, 3\}$. The subgroup $E[n]$ is formed by taking all n-torsion elements of elliptic curve group $E(\overline{\mathbb{F}_p})$. In this paper, we will discuss the construction of Weil pairing as a map from $E[n] \times En$ to a multiplicative group formed by n-th roots of unity in $\overline{\mathbb{F}_p}$. Furthermore, Weil pairing has three important properties, that are bilinearity, identity, and non-degeneracy that make Weil pairing applicable in both cryptanalysis and cryptography. Finally, we will give the "toy" example of implementation of Weil pairing in securing secret message using an algorithm known as Identity Based Encryption (IBE).

2010 Mathematics Subject Classification: 94A60, 14H52.
Keywords: Weil pairing, identity based encryption, cryptography, elliptic curves.

P-12. On near-perfect and deficient perfect numbers with k distinct prime divisors

Carlo Francisco Adajar*, Richell Celeste
University of the Philippines Diliman, The Philippines
{carlo_francisco.adajar, ching}@math.upd.edu.ph

Let $\sigma(n)$ denote the sum of the divisors of n. A near-perfect number is a positive integer n for which $\sigma(n) = 2n + d$, where d divides n. Analogously, a deficient-perfect number is a positive integer for which $\sigma(n) = 2n - d$. We prove that, for any positive integer k, there exist only finitely many odd near-perfect and deficient-perfect numbers with k distinct prime divisors. We also describe an algorithm for computing upper bounds for $\frac{n}{d}$ given a set of prime factors for near-perfect or deficient-perfect n, and, using this, show that $3^4 \cdot 7^2 \cdot 11^2 \cdot 19^2 = 173369889$ is the only odd near-perfect number with exactly four distinct prime divisors.

2010 Mathematics Subject Classification: 11A25.
Keywords: near-perfect number, deficient-perfect number, primitive abundant number.

P-13. Representation of Nakayama algebra

Risnawita
IAIN Bukittinggi, Indonesia
risnawita@yahoo.com

In this paper we explain the correspondence between Nakayama algebra and some directed graph (quiver). An algebra A is said Nakayama Algebra if and only if every indecomposable projective A-Module and every indecomposable injective A-Module are uniserial. A right A -module MA is said to be uniserial if it has unique composition series. The main result of this paper is a basic K-algebra A is nakayama algebra if and only if for every point a of its ordinary quiver QA is the source of at most one arrow and the target of at most one arrow.

2010 Mathematics Subject Classification: 16G20, 16G20.
Keywords: representation, basic algebra, Nakayama algebra.

P-14. Characteristics of cyclically pure injective modules

Nia Yulianti, Hanni Garminia
Algebra Research Group, Institut Teknologi Bandung, Indonesia
nia.yulianti142@gmail.com, garminia@mat.itb.ac.id

The structure of cyclically pure injective modules over a commutative ring R is investigated and several characterizations for them are presented. if we have B be an ideal of R, we prove that any cyclically pure injective R/B module is also cyclically pure injective as an R-module. also, we prove exixtence of cyclically pure injective R-module and cyclically pure homomorphism if we have M as R-module.

Finnaly we show equivalences between cyclically pure injective module, cyclically pure homomorphism, cyclically pure exact sequence, and direct summand of every R-module.

2010 Mathematics Subject Classification: 13C05,13C11.
Keywords: cyclically pure injective module, direct summand, exact sequence, injective module.

P-15. Certificate of positivite in Bernstein basis

Fatima Boudaoud
Oran university Ahmed Benbella, Algeria
fboudaoud@yahoo.fr

Let $P \in \mathbb{Z}[\mathbb{X}]$ be a polynomial of degree p with coefficients in the monomial basis of bit-size bounded by τ. If P is positive on $[-1, 1]$, we obtain a certificate of positivity (i.e. a description of P making obvious that it is positive) of bit-size $O(p^4(\tau+\log_2 p))$. Previous comparable results had a bit-size complexity exponential in p and τ.

2010 Mathematics Subject Classification: 11Y16, 11A05, 13J30.
Keywords: Bernstein basis, polynomials, algorithms.

S03. Algebraic and Complex Geometry, Geometry

Invited Talks

IT-01. Isoperimetric inequalities on Finsler manifolds

Shin-Ichi Ohta
Department of Mathematics, Kyoto University, Japan
sohta@math.kyoto-u.ac.jp

In this talk, we will discuss recent progress of **Lévy–Gromov type isoperimetric** inequalities on Finsler manifolds. A Finsler manifold is a manifold equipped with a (possibly nonreversible) norm on each tangent space. A Lévy–Gromov type isoperimetric inequality compares a manifold of Ricci curvature bounded below with a space form of constant curvature. The classical theorem of Lévy and Gromov deals with positively curved Riemannian manifolds (then the space forms are spheres). E. Milman (JEMS, 2015) gave a generalization to weighted Riemannian manifolds with the combination of a lower weighted Ricci curvature bound $\mathrm{Ric}_N \geq K$ and an upper diameter bound $\mathrm{diam} \leq D$.

Recently, inspired by the localization method in convex geometry as well as its generalization to Riemannian manifolds due to Klartag (MAMS, to appear), Cavalletti– Mondino (arXiv:1502.06465) generalized Milman's inequality to essentially non-branching metric measure spaces satisfying Lott–Sturm–Villani's curvature-dimension condition $\mathrm{CD}(K, N)$, which is a synthetic geometric notion corresponding to $\mathrm{Ric}_N \geq K$. This class especially includes reversible Finsler manifolds of weighted Ricci curvature bounded below, where Lévy–Gromov type isoperimetric inequalities had been previously unknown.

We will review their construction extended to nonreversible Finsler manifolds (Ohta, arXiv:1506.05876), and explain that this method does not give a sharp isoperimetric inequality due to the non-reversibility. If time permits, we will also briefly review another recent development on a semigroup approach (Γ-calculus à la Bakry et al) in the Finsler context (Ohta, arXiv:1602.00390), which gives the sharp isoperimetric inequality in a special situation that $N = D = \infty$ and $K > 0$, even in the nonreversible case.

2010 Mathematics Subject Classification: 53C60, 53C21, 53C23.
Keywords: isoperimetric inequality, Finsler manifold, Ricci curvature, localization.

IT-02. Vanishing theorems for complex projective varieties

Osamu Fujino
Osaka University, Japan
fujino@math.kyoto-u.ac.jp

Let X be a smooth complex projective variety and let H be an ample Cartier divisor on X. Then the celebrated Kodaira vanishing theorem says $H^i(X, \mathcal{O}_X(K_X + H)) = 0$ for every $i > 0$. There are many generalizations of the Kodaira vanishing theorem. The following theorem is one of the most famous generalizations and plays crucial roles in the minimal model program.

Theorem(Kawamata–Viehweg). Let X be a smooth projective variety and let D be an ample $\mathbb{Q}$-divisor on X such that the support of the fractional part of D is a simple normal crossing divisor. Then

$$H^i(X, \mathcal{O}_X(K_X + \lceil D \rceil)) = 0$$

for every $i > 0$, where $\lceil D \rceil$ is the round-up of D.

In this talk, I will explain more powerful vanishing theorems based on the theory of mixed Hodge structures on cohomology with compact support. Our new vanishing theorems contain the Kawamata–Viehweg vanishing theorem, the Kollár vanishing theorem, the (algebraic version of) Nadel vanishing theorem, and so on, as special cases. By our new package of vanishing theorems, we can establish the cone and contraction theorem for semi-log canonical pairs, the projectivity of the moduli spaces of stable varieties, and so on. These results seem to be unreachable by the classical techniques. The following statement is a useful spacial case in our new package of vanishing theorems.

Theorem. Let (Y, Δ) be a simple normal crossing pair such that the coefficients of Δ are in $[0, 1]$. Let $f : Y \to X$ be a proper morphism onto a projective variety X. Let L be a Cartier divisor on Y such that $L - (K_Y + \Delta) \sim_{\mathbb{R}} f^*H$ for some ample $\mathbb{R}$-divisor on X. Then

$$H^p(X, R^q f_* \mathcal{O}_Y(L)) = 0$$

for every $p > 0$ and $q \geq 0$.

2010 Mathematics Subject Classification: 14F17, 14E30.
Keywords: vanishing theorems, mixed Hodge structures, minimal model program.

IT-03. Polynomial automorphisms of $\mathbf{C}^n$ preserving Markoff-Hurwitz polynomial

Hengnan Hu[1], Ser Peow Tan[1], Ying Zhang*[2]
[1]National University of Singapore, [2]Suzhou University
huhengnan@gmail.com, mattansp@nus.edu.sg, yzhang@suda.edu.cn

We study the action of the group of polynomial automorphisms of $\mathbf{C}^n (n \geq 3)$ which preserve the Markoff-Hurwitz polynomial

$$H(x_1, x_2, \cdots, x_n) := x_1^2 + x_2^2 + \cdots + x_n^2 - x_1 x_2 \cdots x_n.$$

Our main results include the determination of the group, the description of a non-empty open subset of $\mathbf{C}^n$ on which the group acts properly discontinuously (domain of discontinuity), and identities for the orbits of points in the domain of discontinuity.

This is the work appeared in the preprint [arXiv:1501.06955].

2010 Mathematics Subject Classification: 57M05, 32G15, 30F60, 20H10, 37F30.
Keywords: Markoff-Hurwitz polynomial, Cayley graph, polynomial automorphisms, Bowditch conditions, identities.

IT-04. $\mathbb{Q}$-Gorenstein deformation and its applications to algebraic surfaces

Yongnam Lee
Korea Advanced Institute of Science and Technology
ynlee@kaist.ac.kr

This talk introduces basic notions of $\mathbb{Q}$-Gorenstein deformation and some applications to algebraic surfaces. $\mathbb{Q}$-Gorenstein deformation theory is applicable to construct surfaces of general type with $p_g = q = 0$ and to find exceptional collections of maximal length of line bundles in Dolgachev surfaces.

2010 Mathematics Subject Classification: 14J29, 14J10.
Keywords: $\mathbb{Q}$-Gorenstein deformation, algebraic surface, exceptional collection.

IT-05. Topology & Robotics

Michel Jambu
University of Nice Sphia Antipolis, France
jambu@unice.fr

Nowadays, robots are used in almost all sectors, industry, medicine, ... , as well as in domestic uses. Many problems of control theory can be solved knowing only the configuration space of the system. Peculiarities in the behavior of the system can often be explained by topological properties of the system's configuration space. Topology enters robotics through the notion of configuration space. The configuration spaces comes with the natural topology (inherited from Euclidean spaces) which reflects the technical limitations of the system. This paper is a short survey of some results on topological robotics. M. Farber introduced the notion of topological complexity which is an important homotopy invariant closely related to the instability of mechanical systems. In a first part, following M. Farber, we recall the definition and properties of the configuration spaces of a mechanical system, of the topological complexity as well as instability of the system. Then, in the second part, we focus on some configuration spaces, the complements of hyperplane arrangements. We recall some results obtained by M. Farber and S. Yuzvinski and we extend these results to the fiber-type arrangements.

2010 Mathematics Subject Classification: 20F36, 55M30, 55R80.
Keywords: configuration space, topological complexity.

IT-06. On geometry and topology of circular metric spaces

Poom Kumam
King Mongkut's University of Technology Thonburi
poom.kum@kmutt.ac.th

In this talk, we give the notion and geometry of a circular metric space which extends some kinds of spaces related to the concept of a metric space and some properties of the proposed space. Next, by using these properties, we establish some common fixed point theorems for an infinite family of set-valued operators and some examples to illustrate our main theorems.

2010 Mathematics Subject Classification: 47H04, 47H09, 47H10, 54C60, 54H25.
Keywords: circular metric space, set-valued operator, common fixed point.

Contributed Talks

CT-01. Star-products on functions on finite groups

Chrizaldy Neil Mañibo[1], Job A. Nable[2]
[1]University of Bielefeld, [2]Ateneo De Manila University
cnc.manibo@gmail.com, jnable@ateneo.edu

The aim of this paper is to point out a method of geometrization of some algebraic and analytic structures on the space of complex functions $L^2(G)$ on a finite group G. It starts with a deformation quantization of $L^2(G)$ analogous to Weyl-Wigner quantization

$$f * g = \sum_{x,y \in G} K(x, y, z) f(y) g(z),$$

where the kernel function $K(x, y, z)$ is in terms of the irreducible unitary representations of G. This allows for the introduction of a Lie product and a Jordan product on $L^2(G)$. Moreover, a simple formula, involving Fourier coefficients, relating the star-product $f * g$ to the usual convolution product $f *_c g$ of functions is given. The Lie bracket on $L^2(G)$ induces a Lie (or Poisson) bracket on the dual $L^2(G)^*$ and this permits the expression of the star-product, and hence also of the Lie bracket, Jordan product, and convolution product in terms of tensors. That is, a geometrization of these algebraic and analytic structures is achieved. The method should also work for compact Lie groups.

2010 Mathematics Subject Classification: 53D55, 81S10, 81S30.
Keywords: deformation quantization, star products, finite groups, irreducible representations.

CT-02. On some curvature tensors and sectional curvatures of quasi-Einstein manifolds

Dennis T. Leyson*, Richard S. Lemence
Institute of Mathematics, Coolege of Science, University of the Philippines
{dtleyson, rslemence}@math.upd.edu.ph

As a generalization of Einstein manifolds, Chaki and Maity introduced the notion of quasi-Einstein manifold. In this talk, we will present some results on the sectional curvatures of quasi-Einstein manifolds in the framework of pseudo-Riemannian geometry. Specifically, we will present the sectional curvatures of pseudo-Riemannian manifolds with vanishing concircular curvature tensor and quasi-Einstein manifolds with vanishing Weyl projective curvature tensor, W_3-curvature tensor and W_4-curvature tensor.

2010 Mathematics Subject Classification: 53B30, 53C15.
Keywords: pseudo-Riemannian geometry, quasi-Einstein manifolds, sectional curvatures, curvature tensors.

CT-03. Canonical foliations and submersions in paraquaternionic-like geometries

Gabriel-Eduard Vîlcu
University of Bucharest
gvilcu@upg-ploiesti.ro

The paraquaternionic structures, firstly named quaternionic structures of second kind, have been introduced in geometry by P. Libermann [C.R. Acad. Sc. Paris 234 (1952)]. The theory of paraquaternionic manifolds parallels the theory of quaternionic manifolds, but uses the algebra of paraquaternionic numbers, in which two generators have square 1 and one generator has square -1. Accordingly, such manifolds are equipped with a subbundle of rank 3 in the bundle of the endomorphisms of the tangent bundle, locally spanned by two almost product structures and one almost complex structure. From the metric point of view, the almost paraquaternionic Hermitian manifolds have neutral signature [E. Garcia-Rio, Y. Matsushita, R. Vasquez-Lorenzo, Rocky Mt. J. Math. 31 (2001)]. The counterpart in odd dimension of paraquaternionic geometry was introduced by S. Ianuş, R. Mazzocco and G.E. Vîlcu [Mediterranean J. Math. 3(2006)]. It is called mixed 3-structure and appears in a natural way on lightlike hypersurfaces in paraquaternionic manifolds. I will investigate some classes of submanifolds in manifolds endowed with paraquaternionic and mixed 3-structures which naturally come equipped with some canonical foliations. In particular, some characterizations are provided for these foliations to become semi-Riemannian, i.e. with bundle-like metric. Moreover, we introduce a new class of semi-Riemannian submersions from a manifold endowed with a metric mixed 3-structure onto an almost paraquaternionic Hermitian manifold. We obtain some fundamental properties and discuss the transference of structures and the geometry of the fibers. In particular we obtain that such a submersion is a harmonic map, provided that the total space is mixed 3-cosymplectic or mixed 3-Sasakian. Finally, some non-trivial examples are given.

2010 Mathematics Subject Classification: 53C15, 53C50, 53C40, 53C12.
Keywords: paraquaternionic structure, mixed 3-structure, semi-Riemannian submersion, foliation.

CT-04. Quivers and sheaves

Alexander H. W. Schmitt
Freie Universität Berlin
alexander.schmitt@fu-berlin.de

Quivers are basic combinatorial objects, consisting of vertices and arrows between them. Given a quiver Q and an abelian category A, one may investigate representations of Q in the category A. The best studied case is when A is the category of finite dimensional vector spaces over a field k. Classification problems for quiver representations include the problem of the Jordan normal form as well

as the representation theory of finite dimensional k-algebras. If A is the category of coherent sheaves over a complex projective manifold X, one arrives at the notion of a quiver bundle or sheaf. For the one loop quiver, this yields the concept of a Higgs bundle which is interrelated with the theory of representations of the fundamental group of X. Among the Higgs bundles, we find so-called holomorphic chains which are quiver bundles for a quiver of type A_n. One may classify quiver sheaves by introducing adequate notions of semistability for them and constructing moduli spaces for semistable quiver sheaves as GIT quotients of some generalized quot schemes. This approach was developed by Álvarez-Cónsul, García-Prada, and the speaker. A fundamental question is how the moduli spaces depend on the stability parameter. In particular, one would like to know, if there are infinitely many distinct notions of semistability or not. If not, there are only finitely many distinct moduli spaces. In the talk, we will explain how quivers naturally appear in the theory of vector bundles and sheaves on projective algebraic manifolds. A particularly nice example are so-called instanton bundles on projective spaces. We will report on recent results of the speaker on stability parameters for quiver sheaves in the case the underlying quiver is a circle. For holomorphic chains up to length 5, the picture is now complete. We will illustrate the material by some instructive examples.

2010 Mathematics Subject Classification: 14D20.
Keywords: moduli, semistability, boundedness, quiver, circle.

CT-05. Rigidity theorems of hypersurfaces with free boundary in a wedge in a space form

Juncheol Pyo
Pusan National University
jcpyo@pusan.ac.kr

A geodesic sphere in a space form is characterized in various ways. Among all hypersurfaces of a given volume bounding a domain in a space form, a geodesic sphere has the least area, that is, it is the boundary of an isoperimetric domain in a space form. In this talk, we present some rigidity results about compact hypersurfaces with free boundary in a wedge in a space form. First, we prove that every compact immersed stable constant mean curvature hypersurface with free boundary in a wedge is part of a geodesic sphere centered at a point of the edge of the wedge. Second, we show that the same rigidity result holds for a compact embedded constant higher order mean curvature hypersurface with free boundary in a wedge. Finally, we extend this result to a compact immersed hypersurface with free boundary in a wedge that has the additional property that the ratio of two higher order mean curvatures is constant.

2010 Mathematics Subject Classification: 53C42, 49Q10.
Keywords: geodesic sphere, free boundary surface.

CT-06. Parallel transport on S^n via generalized spherical coordinates

John Gabriel P. Pelias*, Jose Maria P. Balmaceda
University of the Philippines-Diliman
jgpelias@math.upd.edu.ph, jose.balmaceda@gmail.com

Parallel transport of vectors along curves refers to the transport of a vector in such a way that each transported vector is parallel to the previous vector. In the usual flat $\mathbb{R}^n$, parallel transport means keeping vector components constant; i.e. parallel transport maps a vector back to itself. In a general Riemannian manifold M equipped with metric tensor g, parallel transport becomes slightly more complicated; it is accomplished via the Riemannian connection (compatible with g) that connects the local tangent spaces of M. In this general context, parallel transport may not necessarily map a tangent vector back to itself. A nontrivial yet basic example where this may occur is the 2-dimensional sphere S^2, along loops as basic as circles. In this paper, we study parallel transport on the spheres S^n. In particular, we study in detail the parallel transport map on S^2 relative to the Riemannian metric derived from the usual parametrization of S^2 via spherical coordinates. We give explicit formulae for the map, provide conditions when such map is the identity (which is the familiar property in flat Euclidean spaces), and look at some of its invariants. By naturally extending our observations on S^2, we study parallel transport on the n-dimensional sphere, relative to the Riemannian metric derived from the parametrization of S^n via a natural generalization of spherical coordinates on S^2.

2010 Mathematics Subject Classification: 53B05, 53B20, 53B21.
Keywords: parallel transport, Levi-Civita transport, Riemannian connection, sphere, spherical coordinates, holonomy.

CT-07. Interpretation of Serre Swan theorem

Ida Kurnia Waliyanti*, Indah Emilia Wijayanti, M. Farchani Rosyid
Gadjah Mada University
idakurniaku81@gmail.com, {ind_wijayanti, farchani}@ugm.ac.id

The Serre Swan Theorem is one of relation between physics and mathematics science. The theorem explains about equivalence of the category of vector bundles and the category of projective modules. By the Serre Swan Theorem, we will interpret objects on physics into the algebra. In this case, the objects are vector bundles. Let E and X be two topological spaces. Vector bundle E over X is 4-tupel (E, X, π, F), where $\pi : E \to X$ is open and surjective mapping. The space E is called the total space of the bundle, the space X is called the base space of the bundle, the map π is called the projection of the bundle, the space F is a fibre space of bundle, and for each $p \in X$, the subspace $\pi^{-1}(p)$, denoted by E_p, is called the fibre of the bundle over $b \in B$. In this paper, the fibre is isomorphic to the real vector space $\mathbb{R}$. The cross sections of vector bundle E over X is continuous

map σ from X to E, which composition $\pi\sigma$ is identity in X. The set of all cross sections of vector bundle form a module over the ring of continuous function from the base space (X) to the real space $\mathbb{R}$, denote by $C(X)$. Specially, $C(X) - mod$ is a projective module. In this paper, we will give the concrete example to explain the vector bundles, by giving the concrete of base space X. Moreover, we apply the Serre Swan Theorem to the concrete example, to get more information how to interpret object on physics into the algebra notion.

2010 Mathematics Subject Classification: 14D20.
Keywords: vector bundle, projective module, Serre Swan Theorem, cross section.

CT-08. Structure of decoupled systems for input-output group decoupling of regular linear descriptor system with index one

Arman, Ari Suparwanto, Salmah
Universitas Gadjah Mada, Yogyakarta
armanfmipa@gmail.com, ari_suparwanto@ugm.ac.id, syalmah@yahoo.com

This paper addressed the issue of the structure of group decoupled system for regular linear descriptor systems with index at most one via geometric approach. First, we defined the problem of input-output decoupling for regular linear descriptor system with index one. Then, based on the standard decomposition form, we discussed the problem of group decoupled structure for slow subsystem and fast subsystem. With the construction of controllability subspace, then we presented some results that yield a matrix structure of group decoupled system. Characterization of group decoupled system structure yields a normal form for input-output group decoupling of regular linear descriptor system that has index one. With this form, the problem of input-output group decoupling can be considered as an input-output decoupling systems which is controllable consists of independent controllable subsystem.

2010 Mathematics Subject Classification: 20G99.
Keywords: Input-output group decoupling, descriptor system, controllability subspace.

CT-09. Tori and applications of metric tensors of surfaces in 3-spheres

Young Ho Kim
Kyungpook National University
yhkim@knu.ac.kr

The Gauss map is one of interesting smooth maps on a submanifolds of Euclidean and pseudo-Euclidean space, which describes how the immersion behaves in the ambient space. In fact, it is defined as a map of a submanifold of Euclidean space or a pseudo-Euclidean space into the Grassmannian manifold consisting of all oriented planes passing through the origin by the parallel displacement of the tangent space at a point to an oriented plane of the Grassmannian manifold. In

this talk, we introduce how the Gauss map plays a role to classify or characterize tori by adopting a new metric on the surface of a unit 3-sphere.

2010 Mathematics Subject Classification: 53C40, 53B25.
Keywords: Gauss map, Clifford torus, finite type.

CT-10. On the solution of a second order functional differential equation with a state derivative dependent delay

J. Somsuwan*, K. M. Nakprasit
Dept. of Math., Faculty of Sciences, Khon Kaen University, Thailand
{jira.somsu, kmaneeruk}@hotmail.com

The second order functional differential equation with a state derivative dependent delay of the form $a_2x''(z) + a_1x'(z) + a_0x(z) = x(p(z) + bx'(z)) + h(z)$ has been studied. Considering a convergent power series $g(z)$ of an auxiliary equation $a_2\gamma^2 g''(\gamma z)g'(z) = [g(\gamma^2 z) - p(g(\gamma z))]\gamma g'(\gamma z)(g'(z))^2 + bh'(g(z))(g'(z))^3 + \Big(a_2p''(g(z))+a_1p'(g(z))+a_0p(g(z))\Big)(g'(z))^3 - a_1\gamma g'(\gamma z)(g'(z))^2 - a_0g(\gamma z)(g'(z))^3 + a_2\gamma g'(\gamma z)g''(z)$ with the relation $p(z)+bx'(z) = g(\gamma g^{-1}(z))$, we obtain an analytic solution $x(z)$. Moreover, an analytic solution depends on a parameter γ which satisfies one of the following conditions: $(H1)$ $0 < |\gamma| < 1$, $(H2)$ $\gamma = e^{2\pi i\theta}$ where θ is a Brjuno number or $(H3)$ $\gamma = e^{2\pi i\theta}$ where θ is a rational number.

2010 Mathematics Subject Classification: 34K05.
Keywords: analytic solution.

CT-11. The rigidity theorem of the catenoid and generalized Scherk's surfaces

Daehwan Kim*, Juncheol Pyo
Department of Mathematics, Pusan National University
{daehwan, jcpyo}@pusan.ac.kr

Catenoids and Scherk's surfaces (doubly periodic minimal surfaces) are classical minimal surfaces. The catenoid can be foliated by circles with different radii. The Scherk's surface can be foliated by congruent curves along planar curve. In this talk, we consider two surfaces foliated by similar planar curves. One is that the surface is minimal and foliated by homothetic curves without translations, this surface is either a plane or a catenoid. The other is that the nonplanar minimal surface foliated by congruent planar curves along a space curve is a generalized Scherk's surface.

2010 Mathematics Subject Classification: 53A10.
Keywords: catenoid, generalized Scherk's surface, minimal surface, foliation.

CT-12. Transversally harmonic and biharmonic maps on foliated manifolds

Seoung Dal Jung
Jeju National University
sdjung@jejunu.ac.kr

Let $(M, \mathcal{F})$ and $(M', \mathcal{F}')$ be two foliated Riemannian manifolds and let $\phi : M \to M'$ be a smooth foliated map, i.e., ϕ is a leaf-preserving map. Then ϕ is a transversally harmonic map if it is a solution of $\tau_b(\phi) = 0$, where $\tau_b(\phi)$ is a transversal tension field, which is given by $\tau_b(\phi) = \mathrm{tr}_Q \tilde{\nabla} d_T \phi$. That is, transversally harmonic maps are considered as harmonic maps between the leaf spaces. In this talk, we study the several properties of transversally harmonic and biharmonic maps. Specially, we give the variation formulas for transversal energy functional.

2010 Mathematics Subject Classification: 53C12
Keywords: transversally harmonic and biharmonic map, Foliated Riemannian manifold

CT-13. Interaction of point vortices and a solid cylinder in a viscous fluid

Ohn Mar
University of Mandalay
rose65.om@gmail.com

The derivation of the generalized Blasius formula which is an exact formula for a force that acts on a moving body embedded in a flow of a viscous fluid, based on the incompressible Navier-Stokes equations in two dimensions is reconsidered. This generalized Blasius formula was first derived by Imai(1974). This force formula has broad applicability, making allowance for unsteadiness and vorticity of the flow around the body. It is slightly generalized the work of Imai by allowing for the first time to a circular cylinder interacting two point vortices. It is found that the unsteadiness of the motion of the point vortices contribute to the force acting on the cylinder.

2010 Mathematics Subject Classification: 76D09.
Keywords: Blasius formula, vortices, circular cylinder, unsteadiness.

CT-14. Normal families of meromorphic mappings sharing hypersurfaces

Nguyen Thi Thu Hang
Hai Phong University, Vietnam
hangntt82@dhhp.edu.vn

The Little Picard Theorem states that if a meromorphic function on the complex plane $\mathbb{C}$ omits three distinct points in $\overline{\mathbb{C}}$ then it is a constant function; and the classical result of Montel says that the family $\mathcal{F}$ of meromorphic functions on a domain $D \subset \mathbb{C}$ is normal if there are three distinct points $a, b, c \in \overline{\mathbb{C}}$ such that each element of $\mathcal{F}$ omits each of a, b, and c in D. According to Bloch's principle,

to every "Picard-type" theorem there should belong a corresponding normality criterion.The Little Picard Theorem was generalized to the case of entire curves in the complement of $2n+1$ hyperplanes in general position in $\mathbb{C}P^n$ by Fujimomto, and to the case of entire curves in the complement of $2n+1$ hypersurfaces in general position in $\mathbb{C}P^n$ by Eremenko. In this paper, we prove some normality criteria for families of meromorphic mappings of a domain $D \subset \mathbb{C}^m$ into the complex projective space $\mathbb{C}P^n$ under a condition on the inverse images (ignoring counting multiplicities) of moving hypersurfaces.

2010 Mathematics Subject Classification: 32A10, 32C10, 32H20.
Keywords: normal family, meromorphic mappings, moving hypersurfaces, nevanlinna theory.

Poster Session

P-01. Some properties of lorentzian α-sasakian manifolds with respect to quarter-symmetric metric connection

Santu Dey, Arindam Bhattacharyya
Department of Mathematics, Jadavpur University, India
santu.mathju@gmail.com, bhattachar1968@yahoo.co.in

The aim of this paper is to study generalized recurrent, generalized Ricci-recurrent, weakly symmetric and weakly Ricci-symmetric, semi-generalized recurrent, semi-generali zed Ricci-recurrent Lorentzian a-Sasakian manifold with respect to quarter-symmetric metric connection. Finally, we give an example of 3-dimensional Lorentzian a-Sasakian manifold with respect to quarter-symmetric metric connection.

2010 Mathematics Subject Classification: 53C25.
Keywords: Lorentzian αa-Sasakian manifold, generalized recurrent manifold, weakly symmetric manifold, semi-generalized recurrent manifold, Einstein manifold.

P-02. The second Hankel determinant of functions close-to-convex

Marjono*[1], D. K. Thomas[2]
[1]Department of Mathematics, FMIPA, University of Brawijaya, Malang, Indonesia
[2]Department of Mathematics, Swansea University, UK
marjono@ub.ac.id, d.k.thomas@swansea.ac.uk

It is shown that if f is analytic in $z \in D = \{z : |z| < 1\}$ with $f(z) = z + \sum_{n=2}^{\infty} a_n z^n$, and is convex in one direction, then the second Hankel determinant $H_2(2) = |a_2 a_4 - a_3^2| \leq 1$. The inequality is sharp. We use the triangle inequality to find the upper bound and the equality is sharp when $f(z)$ is Koebe function $f(z) = k(z)$. We will find the sharp upper bound for $H_2(2) \in K$.

2010 Mathematics Subject Classification: 30C45, 30C50.

Keywords: univalent functions, Koebe function, starlike, close-to-convex, Hankel determinants.

P-03. An optimization and adaptation method for arbitrary polygonal grids

Zihuan Dai
Beijing Institute of Applied Physics and Computational Mathematics, China
dai_zihuan@qq.com

We develop an optimization and adaptation method for arbitrary polygonal grids in this paper. The key idea of this method is to solve the modified gradient flow equation of the grid functional by using the finite volume method (FVM). We will present in detail the FVM discretization method of the modified gradient flow equation. The discretization scheme thus obtained is solved by a two-level iteration method which we develop. Numerical examples are given to optimize/adapt some polygonal grids which include triangle meshes, mixed meshes composed of triangle cells and quadrilateral cells and Voronoi mshes. Numerical results show the affection of this new strategy.

2010 Mathematics Subject Classification: 13P25.
Keywords: polygonal grid, optimization, adaptation.

P-04. Monocornal tilings of the hyperbolic plane

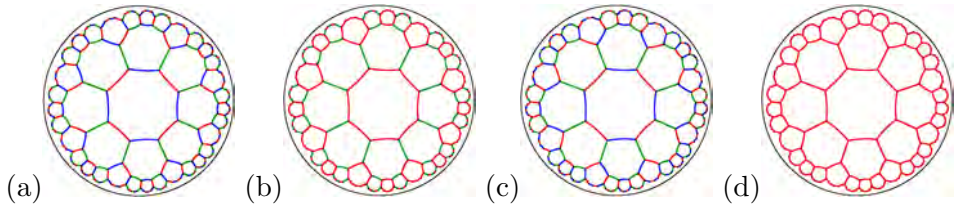
Eduard C. Taganap*[1], Ma. Louise Antonette De Las Peñas[2]
[1]Central Luzon State University, Nueva Ecija, Philippines
[2]Ateneo de Manila University, Quezon City, Philippines
eduardtaganap@gmail.com, mdelaspenas@ateneo.edu

The *vertex corona* of a vertex in a tiling is the patch of all tiles adjacent to this vertex. A tiling where all vertex coronae are congruent is called *monocoronal*. Frettlöh and Garber, in [1], tackled the problem of classifying monocoronal tilings in the Euclidean plane and arriving at a list of all possible symmetry groups of monocoronal tilings. In this work, we deal with the same problem by considering tilings by convex polygons of the hyperbolic plane. We focus on face-to-face two dimensional hyperbolic monocoronal tilings congruent with respect to direct isometries (mirror reflections are not allowed).

The problem of listing all the monocoronal tilings requires determining the possible combinatorial types of vertex coronae in a monocoronal tiling, and providing a method of coloring the edges in a vertex corona to mark equal edges or predefined angles. In this talk, we discuss results pertaining to 3-valent hyperbolic monocoronal tilings wherein we have the following possible types of vertex coronae: (i) $p-p-p$ (consisting of three p-gons) where $p \geq 7$; (ii) $p-2q-2q$ (consisting of a p-gon and two $2q$-gons) where $\frac{1}{p}+\frac{1}{q}<\frac{1}{2}$ and $p \neq 2q$; and (iii) $2p-2q-2r$ (consisting of a $2p$-gon, a $2q$-gon and a $2r$-gon) where p, q, and r are pairwise distinct and $\frac{1}{p}+\frac{1}{q}+\frac{1}{r}<1$.

To illustrate case (i), for example, we have the following possibilities for the $p-p-p$ vertex types depending on the value of p: (a) three non-congruent irregular p-gons (p is even and divisible by 4); (b) two congruent irregular p-gons and a regular p-gon (p is even); (c) three irregular p-gons where two of them are congruent (p is even); and (d) three regular p-gons. The symmetry groups of a monocoronal $p-p-p$ tiling expressed in Conway notation are $2*(\frac{p}{2})(\frac{p}{4}), *p(\frac{p}{2})2, *(\frac{p}{2})(\frac{p}{2})(\frac{p}{2})$, or $*p32$.

Shown below are families of $8-8-8$ monocoronal tilings where equal edges are marked with the same color. These correspond to the four cases described above.



2010 Mathematics Subject Classification: 52C20, 20F67, 52C45.
Keywords: monocoronal tilings, hyperbolic groups, symmetry groups, tilings.

P-05. An aperiodic tiling with 6-fold rotational symmetry

April Lynne D. Say-awen*[1], Ma. Louise Antonette N. De Las Peñas[1]
Dirk Frettlöh[2]
[1]Ateneo de Manila University, Philippines, [2]Universität Bielefeld, Germany
abrilsayawen@gmail.com, mdelaspenas@ateneo.edu, dirk.frettloeh@math.uni-bielefeld.de

Aperiodic tilings are of interest both for their interesting algebraic and geometric properties, and their applications to crystallography. In this paper, we present the construction of an aperiodic tiling $\mathcal{T}$ that has $6-$fold rotational symmetry using a substitution rule σ with substitution factor $\sqrt{7}$ and prototile set consisting of four prototiles: a regular hexagon, two equilateral triangles and a scalene triangle. Moreover, the substitution rule σ is primitive; that is, there is $k \in \mathbb{N}$ such that each $k-$order supertile contains congruent copies of the four prototiles.

Apart from showing that $\mathcal{T}$ is aperiodic, other properties pertaining to $\mathcal{T}$ will be presented. One property is that $\mathcal{T}$ has finite local complexity (FLC) with respect to rigid motions. That is, there are only finitely many non-congruent two-tile patches of $\mathcal{T}$. For this tiling this can be proven by deriving all the vertex stars of $\mathcal{T}$. By a vertex star we mean a figure consisting of a vertex together with its incident tiles. Finally we present the derivation of the frequency module of $\mathcal{T}$. In this case, the frequency module of $\mathcal{T}$ is $\mathbb{Z}\left[\frac{1}{7}\right]-$module generated by the frequencies of the prototiles together with the frequencies of the edges and its vertex stars. To derive the prototile frequency, we apply the well-known Perron-Frobenius method which

involves the substitution matrix of σ. To extract the frequencies of the edges and vertex stars, we introduce three additional primitive substitutions that give rise to substitution tilings that can be obtained from $\mathcal{T}$ by some local rules.

2010 Mathematics Subject Classification: 52C20, 52C23.

Keywords: aperiodic tilings, substitution tilings with $n-$fold rotational symmetry, finite local complexity.

P-06. On geometric properties of q-Bézier curves

Zhi Liu[1], Yan-Yan Lv[1], Xiao-Yan Liu*[2], Ping Jiang[1]
[1]School of Mathematics, Hefei University of Technology, China
[2]Department of Mathematics, University of La Verne, USA
xliu@laverne.edu

q-Bézier curve is a type of useful modeling tool in computer aided geometric design and computer graphics. The geometric properties of cubic q-Bézier curve are analyzed by using the technique based on the theory of envelope and topological mapping. Necessary and sufficient conditions are derived for this curve to have one or two inflection points, a loop or a cusp, being locally or globally convex. Those conditions are completely characterized by the relative position of the edge vectors of the control polygon and parameter q. The results are summarized in a shape diagram, which is useful when cubic q-Bézier curves are used for geometric modeling. Furthermore we discussed the influences of the parameter q on the shape diagram and the ability for adjusting the shape of the curve.

2010 Mathematics Subject Classification: 19L64.

Keywords: q-Bézier curve, geometric modelling, topological mapping.

S04. Topology, Analysis and its Applications

Invited Talks

IT-01. Dynamics of Hénon maps on $\mathbf{C}^n$ via pluripotential methods

Tien-Cuong Dinh
National University of Singapore
matdtc@nus.edu.sg

Hénon maps were introduced in dimension 2 by Michel Hénon and in higher dimension by Nessim Sibony. In the complex setting, they provide the first non-trivial examples of non-uniformly hyperbolic systems in arbitrary dimensions. Despite their simple expression in coordinates, the associated dynamical systems are often very complicated and interesting. Dynamics of Hénon maps is currently a very challenging research topic. In the real category, most of the questions are still open. In the holomorphic setting, one can use powerful tools from complex analysis. There are two main difficulties

(1) these maps are highly non-uniformly hyperbolic, and
(2) the numbers of stable and unstable directions are arbitrary.

I will report some fundamental dynamical properties of Hénon maps, e.g. their ergodic properties and the equidistribution of the orbits of varieties or of periodic points. Recent tools from pluripotential theory will be also presented. These techniques allow to handle the main difficulties mentioned above. These basic tools for holomorphic dynamics in higher dimension are of independent interest and can be used in other research areas. A large part of this presentation is based on my joint work with Nessim Sibony.

2010 Mathematics Subject Classification: 32U, 37F, 32H50.
Keywords: Hénon maps, equilibrium measure, exponential mixing, ergodicity, periodic points, positive closed currents.

IT-02. Renormalized volumes and Chern Simons invariants for some non-compact hyperbolic 3 manifolds of infinite volumes

Jinsung Park
Institute for Advanced Study, Korea
jinsung@kias.re.kr

In this talk, I will explain the holography correspondence between some non-compact hyperbolic 3 manifolds of infinite volumes and thier conformal boundary Riemann surfaces. This is given by the equalities involving renormalized volumes, Chern Simons invariants of hyperbolic 3 manifolds and classical Liouville action functionals, Bergman Tau functions defined over boundary Riemann surfaces.

2010 Mathematics Subject Classification: 30F10.
Keywords: renormalized volume, Chern Simons invariant, classical Liouville action functional, Bergman Tau function.

IT-03. Measures of noncompactness with certain applications

M. Mursaleen
Aligarh Muslim University, India
mursaleenm@gmail.com

In this talk, we present technique of measures of noncompactness to characterize compact operators between some sequence spaces. We also present some applications of measures of noncompactness to the theory of infinite system of differential equations in some sequence spaces. Further, we present some new results on applications to integral equations.

2010 Mathematics Subject Classification: 46A45, 46B50, 46H05.
Keywords: sequence spaces, matrix transformations, measures of noncompactness, compact operators.

IT-04. Braid presentation of surface-links in 4-space

Seiichi Kamada
Osaka City University, Japan
skamada@sci.osaka-cu.ac.jp

We discuss braid presentations of surface-links in the Euclidean 4-space. First we introduce the classical dimensional case. Alexander and Markov's theorems state that every link in the Euclidean 3-space can be presented as a closed braid (the closure of a braid), and such a braid presentation is unique up to braid ambient isotopy, conjugation and stabilization. An analogous result holds for surface-links in the 4-space. O. Viro and I showed that every surface-link can be presented as a closed surface-braid. Such a braid presentation is unique up to braid ambient isotopy, conjugation and stabilization. A similar result holds for immersed surface-links too.

2010 Mathematics Subject Classification: 57Q45, 57M25.
Keywords: braid, knot, surface-link.

IT-05. The Bohr phenomenon for analytic and harmonic mappings

Rosihan M. Ali
Universiti Sains Malaysia
rosihan@usm.my

The Bohr phenomenon, first introduced by Harald Bohr in 1914, deals with finding the largest radius r, $0 < r < 1$, such that $\sum_{n=0}^{\infty} |a_n| r^n \leq 1$ holds whenever $|\sum_{n=0}^{\infty} a_n z^n| \leq 1$ in the unit disk U of the complex plane. The exact value of this largest radius, known as the *Bohr radius*, has been established to be $1/3$. Thus $d\left(\sum_{n=0}^{\infty} |a_n z^n|, |a_0|\right) \leq d(f(0), \partial U)$ for every analytic self-map f of the unit disk, where d is the Euclidean distance, and $|z| \leq 1/3$. Here we find the Bohr radius for certain power series in U. The Bohr radius is also studied for analytic functions from U into particular domains, which include the punctured unit disk, the exterior of the closed unit disk, and a concave wedge-domain. The analogous Bohr radius is also studied for harmonic and log-harmonic mappings in U The Bohr phenomenon which is described in terms of the Euclidean distance will be further investigated using the spherical chordal metric and the Poincare metric.

2010 Mathematics Subject Classification: 31A05.
Keywords: Bohr radius, analytic functions, harmonic functions, Poincare metric, concave wedge-domain.

IT-06. A series of coefficient problems concerning the so-called Fekete-Szegö theorem

Maslina Darus
Universiti Kebangsaan Malaysia
maslina@ukm.edu.my

In this particular section, univalent function theory will be summarised. It all started back in 1907 when P. Koebe, a German Mathematician introduced the largest analytic univalent functions in the open unit disc given as

$$k(z) = \frac{z}{(1-z)^2}.$$

This class of functions will be denoted by S. Without loss of generality, we can normalise f and write as the following

$$f(z) = \sum_{z=2}^{\infty} a_n z^n.$$

Back in 1916, a coefficient problem so-called the Bieberbach Conjecture was the most important problem to be proved. It stated that: If f in S, then $|a_n| \leq n$ for all $n \geq 2$ with equality for the rotation of Koebe function k. The conjecture is settled, yet many interesting problems remain. In the talk, coefficient problems related to the so-called Fekete-Szegö theorem will be focused. Subclasses of S such as the starlike functions, convex functions and close-to-convex functions dealing with the Fekete-Szegö problems will be mentioned. Known and new results will be discussed. Finally, open problems will be posted.

2010 Mathematics Subject Classification: 52A41.
Keywords: starlike functions, convex functions, close-to-convex functions, Fekete-Szegö problems.

IT-07. Recent development of fixed point theory and optimization and its applications

Suthep Suantai
Department of Matematics, Chaing Mai University, Thailand
suthep.s@cmu.ac.th

Fixed Point Theory plays very important role in nonlinear analysis, theory of equations and inequalities, approximation theory, economic, engineering and physic. Many problems in science and applied science can be formulated in the form of equations, inequality, system of equations and inequalities which represent their models. Two main problems arise for solving those equations and inequalities. The first one is the existence problem, how can we know that those equations have a solution? Fixed point theory in various spaces, especially in Banach spaces, can be applied to answer this question. Among several theories using to guarantee the existence of a solution of such equations, Fixed Point Theory (more than 90In this talk, we first mention first period works in fixed point theory such as Banach Contraction Principle, and then give several directions how to generalize the Banach Contraction Principle in many ways, both for single and multi-valued mappings after that new fixed point theorems will be discussed. Then we pay attention on applications of fixed point theory in other areas such as economic, optimization, physic, engineering and computer science. Finally, some interesting and challenging problems related to fixed point theory and its applications are posed and discussed.

2010 Mathematics Subject Classification: 37C25, 46B25.
Keywords: fixed point theory, Banach spaces.

IT-08. Schubert calculus and cohomology of Lie groups

Haibao Duan
Institute of Mathematics, Chinese Academy of Sciences, China
dhb@math.ac.cn

The problem of computing the cohomology of Lie groups was raiseby E. Cartan in 1929. It is a focus of algebraic topology for the fundamental role of Lie groups playing in geometry and topolgy. On the other hand Schubert caculus began with the interesection theory of the 19th century. Clarifying this calculus was an important problem of algebraic geometry. In this talk we present a linkage between these two topics both with distinguished backgrounds. We demonstrate how Schubert calculus could be extended to yield an explicit and unified construction for the integral cohomologies of all 1-connected Lie groups.

2010 Mathematics Subject Classification: 17B56.
Keywords: Lie groups, Schubert calculus, cohomology.

Contributed Talks

CT-01. Hyperstability and stability of a logarithm-type functional equation

Young Whan Lee*[1], Gwang Hui Kim[2]
[1]Daejeon University, [2]Kangnam University
ywlee@dju.ac.kr, ghkim@kangnam.ac.kr

From the following functional equation $f(pr, qs) + f(ps, qr) = (r + s)f(p, q) + (p+q)f(r, s)$, which is related to distance measure, we can consider the logarithm-type functional equation $\frac{1}{2}[f(pr, qs) + f(ps, qr)] = f(p, q) + f(r, s)$. In this paper, we investigate the hyperstability and stability of the above functional equation as follows : if f satisfies a stability inequality for the above equation then it is also a solution of this equation or we can find an another solution of it which has the small error bound.

2010 Mathematics Subject Classification: 39B82, 39B52.
Keywords: information measure, distance measure, superstability, multiplicative function, stability of functional equation.

CT-02. A new topology on the Denjoy space

Dewi Kartika Sari*, Peng-Yee Lee, Dongsheng Zhao
Mathematics and Mathematics Education, NIE-NTU
nie15dewi2662@e.ntu.edu.sg, {pengyee.lee, dongsheng.zhao}@nie.edu.sg

Following Kurzweil and Jarnik (1997), we define a new topology in the space P of the primitives of Henstock-Kurzweil integrable functions on [0,1] in terms of

a neighbourhood system. Furthermore, we give two more examples of this type of topology defined on the two-norm spaces $BV[0,1]$ and $L_\infty[0,1]$.

2010 Mathematics Subject Classification: 26A39, 26A45, 54D70, 54F65.
Keywords: two-norm convergence, the Denjoy space, $BV[0,1]$, $L_\infty[0,1]$.

CT-03. Convolution theorem for two-sided quaternion linear canonical transform

Mawardi Bahri
Department of Mathematics, Hasanuddin University, Makassar 90245, Indonesia
mawardibahri@gmail.com

The quaternion linear canonical transform (QLCT) is a generalization of the linear canonical transform (LCT) using quaternion algebra. According to definitions of the quaternion Fourier transform (QFT), there are basically two ways of obtaining the QLCT: the (right-sided) quaternion linear canonical transform and the (two-sided) quaternion linear canonical transform. The (right-sided) quaternion linear canonical transform is obtained by substituting the Fourier kernel with the the right-sided QFT kernel in the LCT definition. Some important properties such as the Parseval's theorem, reconstruction formula, and uncertainty principles were also discussed. However, the convolution theorem is an important result of the QLCT which does not hold using this construction because of the non-commutative property of the (right sided) quaternion Fourier kernel.

In this paper, we first introduce the (two-sided) quaternion linear canonical transform (QLCT) and then establish the relationship between the QLCT and QFT. The QLCT definition proposed in this paper enables us to establish the convolution theorem, which can be useful in digital signal and image processing. We also find relationship between the convolution theorem of the QLCT and convolution theorem of the QFT.

2010 Mathematics Subject Classification: 46E10, 46E35, 46F05, 47G30.
Keywords: quaternion convolution, quaternion linear canonical transform, quaternion Fourier transform.

CT-04. Convolution and product theorems for Quaternionic fractional fourier transform

R. Roopkumar
Department of Mathematics, Central University of Kerala, Kasaragod, India
roopkumarr@gmail.com

Although the convolution theorem $F(f*\phi) = F(f)F(\phi)$ is satisfied by the classical Fourier transform, the Fractional Fourier transform fails to satisfy the same. However, by redefining the convolution suitably, a similar version of a convolution theorem $\mathcal{F}_\alpha(f \star g)(u) = \mathcal{F}_\alpha(f)(u)\mathcal{F}_\alpha(g)(u)e^{-ia(\alpha)u^2}$, $\forall u \in \mathbb{R}$ is obtained for

fractional Fourier transform in "[1] A. I. Zayed, A convolution and product theorem for the fractional Fourier transform, *IEEE Signal Processing Letters*, **5** (1998), 101–103." where $\mathcal{F}_\alpha(f)(u) = \frac{c(\alpha)}{\sqrt{2\pi}} \int f(x) e^{i[a(\alpha)(x^2+u^2-2b(\alpha)ux)]}\, dx$ and $(f \star g)(x) = \frac{c(\alpha)}{\sqrt{2\pi}} e^{ia(\alpha)x^2} (\tilde{f} * \tilde{g})(x)$, where $a_\alpha = \frac{\cot\alpha}{2}, b_\alpha = \sec\alpha$ and $c_\alpha = \sqrt{1 - i\cot\alpha}$ and $\tilde{f}(x) = f(x)e^{ia(\alpha)x^2}$ and for some suitable $\alpha \in \mathbb{R}$. It is well known that the set $\mathbb{H} = \{p_1 + jp_2 : p_1, p_2 \in \mathbb{C}\}$ of all quaternions is a division ring, with respect to $(p_1 + jp_2) + (q_1 + jq_2) = (p_1 + q_1) + j(p_2 + q_2)$ and $(p_1 + jp_2)(q_1 + jq_2) = (p_1q_1 - \bar{p}_2q_2) + j(\bar{p}_1q_2 + p_2q_1)$, where $j^2 = -1$. There are plenty of works on quaternion valued functions in the literature, which are having applications on color image processing. Although the fractional Fourier transforms of quaternion valued functions are studied in the literature, there is no nice convolution theorem in this context, because of the non-commutativity of quaternion multiplication. See "X. Guanlei, W. Xiaotong, X. Xiaogang, Fractional quaternion Fourier transform, convolution and correlation, *Signal Processing*, **88** (2008), 2511–2517." In this paper, we introduce two convolutions for quaternion valued functions and prove the convolution and product theorems for quaternionic fractional Fourier transform, which are analogous to those introduced in [1], using the convolution of quaternion valued functions introduced in "L. Akila and R. Roopkumar, A natural convolution of quaternion valued functions and its applications, *Appl. Math. Comput.*, **242** (2014), 633–642."

2010 Mathematics Subject Classification: 44A15, 44A35, 46S10.
Keywords: fractional Fourier transform, quaternion valued functions, convolution.

CT-05. The boundedness of generalized Bessel-Riesz operators on generalized Morrey spaces

M. Idris*, H. Gunawan
Institut Teknologi Bandung, Indonesia
mochidris@students.itb.ac.id, hgunawan@math.itb.ac.id

The purpose of this paper is to prove the boundedness of generalized Bessel-Riesz operators on generalized Morrey spaces. The kernel of the operators contain some parameters, one of which is related to Bessel decay. As usual, we use the usual dyadic decomposition, Hölder inequality, a Hedberg-type inequality for the operators, and the boundedness of Hardy-Littlewood maximal operator in the proofs. In addition, we also exploit the relationship between the parameters of the kernel and of the space. We obtain that the norm of the operators is dominated by the norm of the kernels.

2010 Mathematics Subject Classification: Primary 42B20; Secondary 26A33, 42B25, 26D10, 47G10.
Keywords: Generalized Bessel-Riesz operators, Hardy-Littlewood maximal operator, generalized Morrey spaces.

CT-06. $g^{**}\mu b$-sets in generalized fuzzy topological spaces

Lovely B. Bacara, Helen M. Rara*
Dept. of Math. and Stat., MSU-Iligan Insitute of Technology, Philippines
lovely.bacara@g.msuiit.edu.ph, helenrara@yahoo.com

This paper introduces the concepts of fuzzy $g^{**}\mu b$-open and fuzzy $g^{**}\mu b$-closed sets in a generalized fuzzy topological space (GFTS) (X, μ). Moreover, the fuzzy $g^{**}\mu b$-continuous, regular strongly fuzzy $g^{**}\mu b$-continuous and quasi fuzzy $g^{**}\mu b$-functions and fuzzy $g^{**}\mu b$-separation axioms are presented. Specifically the notions of fuzzy $g^{**}\mu b$-T_1 space, fuzzy $g^{**}\mu b$-T_2 space, fuzzy $g^{**}\mu b$-regular space and the four fuzzy $g^{**}\mu b$-normal spaces are introduced. Some of the important results of this paper are as follows:

1. The fuzzy set ψ in X is fuzzy $g^{**}\mu b$-closed if and only if $gbc_\mu(\psi) \leq \lambda$ whenever $\psi \leq \lambda$ and λ is fuzzy μ-open in X.
2. If every crisp fuzzy singleton in X is fuzzy $g^{**}\mu b$-closed, then (X, μ) is a fuzzy $g^{**}\mu b$-T_1 space.
3. If (X, μ) is fuzzy $g^{**}\mu b$-T_2 space, then for every pair of fuzzy singletons p_1, p_2 with different supports, there exists a fuzzy $g^{**}\mu b$-open set ψ such that $p_1 \leq \psi \leq g^{**}bc_\mu(\psi) \leq 1 - p_2$.
4. Every fuzzy $g^{**}\mu b$-T_1 and fuzzy $g^{**}\mu b$-T_2 spaces are invariant under a quasi fuzzy $g^{**}\mu b$-open bijective function.
5. If (X, μ) is a fuzzy $g^{**}\mu b$-regular space, then for a fuzzy singleton p and a fuzzy μ-open λ such that $p \leq \lambda$, there exists a fuzzy $g^{**}\mu b$-open set σ such that $p \leq \sigma \leq g^{**}bc_\mu(\sigma) \leq \lambda$.
6. If (X, μ) is a fuzzy $g^{**}\mu b_3$-normal space, then for a fuzzy μ-closed set γ and a fuzzy μ-open set λ such that $\gamma \leq \lambda$, there exists a fuzzy $g^{**}\mu b$-open set σ such that $\gamma \leq \sigma \leq g^{**}bc_\mu(\sigma) \leq \lambda$.

2010 Mathematics Subject Classification: 54A40
Keywords: $g^{**}\mu b$-open set, $g^{**}\mu b$-closed set, $g^{**}\mu b$-continuous, regular strongly fuzzy $g^{**}\mu b$-continuous and quasi fuzzy $g^{**}\mu b$-functions, fuzzy $g^{**}\mu b$-separation axioms

CT-07. Itô's formula on operator-valued stochastic process

Mhelmar A. Labendia*[1], Timothy Robin Y. Teng[2], Elvira de Lara-Tuprio[2]
[1]MSU-Iligan Institute of Technology, Philippines
[2]Ateneo de Manila University, Philippines
mhelmar.labendia@g.msuiit.edu.ph, {tteng, edelara-tuprio}@ateneo.edu

Let U and V be separable Hilbert spaces and $f : [0, T] \times \Omega \to L(U, V)$ be an adapted stochastic process on a filtered probability space $(\Omega, \mathcal{F}, \{\mathcal{F}_t\}, \mathbb{P})$, where $L(U, V)$ is the space of all bounded linear operators from U to V. Then f is said to be Itô-Henstock integrable, or $\mathcal{IH}$-integrable, on $[0, T]$ with respect to a U-valued

Wiener process W if there exists $A \in L^2(\Omega, V)$ such that for every $\epsilon > 0$, there exist a positive function δ on $[0,T]$ and a positive number η such that for any (δ,η)-fine belated partial division $D = \{((\xi_i, v_i], \xi_i)\}_{i=1}^n$ of $[0,T]$, we have

$$\mathbb{E}\left[\left\|\sum_{i=1}^{n} f_{\xi_i}(W_{v_i} - W_{\xi_i}) - A\right\|_V^2\right] < \epsilon.$$

In this case, f is $\mathcal{IH}$-integrable to A on $[0,T]$ and A is called the $\mathcal{IH}$-integral of f which will be denoted by $(\mathcal{IH})\int_0^T f_t\, dW_t$. It can be verified that the $\mathcal{IH}$-integral possesses the standard properties of an integral. Under some conditions, it can be shown using Henstock's approach that a mapping $F : U \to V$ satisfies the univariate Itô's formula

$$\begin{aligned} F(W_T) - F(W_0) &= (\mathcal{IH})\int_0^T F'(W_t)\, dW_t \\ &\quad + \frac{1}{2}(\mathcal{R})\int_0^T \sum_{k=1}^{\infty} \lambda_k F''(W_t)(b_k, b_k)\, dt \end{aligned}$$

for almost all $\omega \in \Omega$, where the second integral on the right side of the equation is a Riemann integral and $\{b_k\}$ is an orthonormal basis of U consisting of eigenvectors of a symmetric nonnegative trace-class operator on U with corresponding eigenvalues $\{\lambda_k\}$.

2010 Mathematics Subject Classification: 26A39, 60H05.
Keywords: Itô-Henstock integrable, Wiener process, Itô's formula.

CT-08. Convexity of functions defined by differential inequalities and integral operators

See Keong Lee
Universiti Sains Malaysia
sklee@usm.my

The convexity conditions for analytic functions defined in the open unit disk satisfying certain second-order and third-order differential inequalities are obtained. As a consequence, conditions for convexity of functions defined by integral operators are also determined.

2010 Mathematics Subject Classification: 30C45.
Keywords: convex functions, subordination, differential inequalities, integral operators.

CT-09 Possible decay rate for the solutions of the 2D Euler equations

Jaiok Roh
Hallym University
joroh@hallym.ac.kr

In this talk we will discuss the possible decay rate for the incompressible flows with a initial compact support. And we will see the possible decay rate for the smooth solutions of the 2D Euler equations on R^2. Then we will compare with the decay rate for the smooth solutions of the Navier-Stokes equations.

2010 Mathematics Subject Classification: 35Q30
Keywords: Euler equations, compact support, incompressible flows

CT-10. Homogenization of some evolution problems in domains with small holes

Bituin Cabarrubias*[1], Patrizia Donato[2]
[1]University of the Philippines Diliman, Diliman, Quezon City, Philippines
[2]Université de Rouen, Laboratoire de Mathématiques Raphaël Salem, France
bituin@math.upd.edu.ph, Patrizia.Donato@univ-rouen.fr

This paper deals with the asymptotic behavior of the wave and heat equations in periodically perforated domains with small holes and Dirichlet conditions on the boundary of the holes. We first extend the periodic unfolding method for domains with small holes to time-dependent functions and then use this extension to homogenize the wave and heat equations with oscillating coefficients in domains with small holes. The wave results here extend those that are already known in the literature for the case where the elliptic part of the operator is the Laplacian.

2010 Mathematics Subject Classification: 35B27, 35L20, 35K20.
Keywords: homogenization, small holes, unfolding, wave equation, heat equation.

CT-11. The strong version of the countably Lipschitz integral

Ch. Rini Indrati, Lina Aryati
Dept. of Mathematics FMIPA UGM, Indonesia
rinii@ugm.ac.id, lina@ugm.ac.id

Based on strongly countably Lipschitz condition, it will be constructed a new type of integral. It is called CL^*-integral. The integral is more general than the Lebesgue integral.

Descriptively, the new integral is simpler than the Henstock integral. It is also simpler than the countably Lipschitz integral (CL-integral). It is not like in the Henstock integral, by this new integral, it will be easier to characterize a function will be integrable or not.

In the discussion, it will be given some properties of the constructed integral and some its convergence theorems. The characteristics will be given by using truncated function.

2010 Mathematics Subject Classification: 26A39.
Keywords: strongly countably Lipschitz condition, the Lebesgue integral, the Henstock integral, truncated function.

CT-12. Bounded 2-linear functional on the n-normed spaces

H. Batkunde*, F. Y. Rumlawang
Dept. of Math., Faulty of Math. and Natural Sciences, Pattimura University
{h.batkunde, rumlawang}@fmipa.unpatti.ac.id

The concept of n-normed spaces ($n \leq 2$) was initially introduced by S. Gähler, and that of n-inner product spaces ($n \leq 2$) was developed by Misiak. Using these concepts, this reasearch will discuss about bounded 2-linear functional as known as bounded bilinear functionals on the n-normed spaces which can be defined in several ways (with respect to the type of boundedness). We shall be interested to evaluate the norm of these functionals as well as the dual spaces which are formed by the bounded 2-linear functionals defined earlier.

2010 Mathematics Subject Classification: 46S30.
Keywords: bounded bilinear functional, bounded 2-linear functional, n-normed spaces.

CT-13. Some Meir-Keeler type common fixed point theorems in dislocated metric space

Dinesh Panthi
Dept. of Math., Valmeeki Campus, Nepal Sanskrit University, Nepal
panthid06@gmail.com

In 1986, S. G. Matthews introduced the concept of dislocated metric space in the context of domain theory. In 2000, P. Hitzler and A. K. Seda introduced the concept of dislocated topology and provided some variants along with dislocated metric space and established fixed point theorems. Since then, a number of fixed point theorems have been established by several authors in this space. In this paper we establish some fixed point theorems for mappings satisfying contractive condition of Meir- Keeler type in dislocated metric space which generalize and improve similar results in the literature.

2010 Mathematics Subject Classification: 47H10, 54H25.
Keywords: dislocated metric space, common fixed point, cauchy sequence, convergence.

CT-14. An approach to limit theorems for nonlinear integrals by perturbative method

Jun Kawabe
Shinshu University, Japan
jkawabe@shinshu-u.ac.jp

In 1974 Sugeno introduced the notion of fuzzy measure and fuzzy integral, which are now generalized to the nonadditive measure (also called the monotone measure) and the Sugeno integral, to evaluate nonadditive or nonlinear quality in systems engineering. This type of set function, in conjunction with several types of nonlinear integrals, is closely related to the theory of capacities and imprecise probabilities and has been extensively studied with applications to decision theory under uncertainty, game theory, data mining, and some economic topics under Knightian uncertainty and others. In order to put nonlinear integrals into practical use, it is inevitable to formulate limit theorems assuring that the limit of the integrals of a sequence of functions is the integral of the limit function. Thus many attempts have been made to formulate such limit theorems for nonlinear integrals such as the Choquet, the Šipoš, the Sugeno, and the Shilkret integrals. However, to the best of my knowledge, there is in literature no unified approach to limit theorems that are simultaneously applicable to both the Lebesgue integral as a linear integral and the Choquet, the Šipoš, the Sugeno, and the Shilkret integrals as nonlinear integrals. The purpose of the talk is to present a unified approach to limit theorems for nonlinear integrals. As well as the Lebesgue integral, a nonlinear integral may be viewed as a nonlinear functional $I\colon \mathcal{M}(X) \times \mathcal{F}^+(X) \to [0,\infty]$, where X is a non-empty set, $\mathcal{A}$ is a field of subsets of X, $\mathcal{M}(X)$ is the set of all nonadditive measures on $(X,\mathcal{A})$, and $\mathcal{F}^+(X)$ is the set of all $\mathcal{A}$-measurable nonnegative functions on X. So we formulate our general type of limit theorem for such a functional. In particular we report that the famous limit theorems for nonlinear integrals such as the bounded/monotone/dominated convergence theorems follow from our limit theorems for functionals regardless of the type of nonlinear integrals. The key tool is a perturbation of functional that manages not only the monotonicity of the functional but also the small change of the value $I(\mu, f)$ caused by adding small amounts to a measure μ and a function f in the domain of the functional.

2010 Mathematics Subject Classification: 28E30, 28A33, 28C15.
Keywords: nonadditive measure, nonlinear integral, limit theorem, perturbation.

CT-15. Checkerboard colorable virtual knot

Naoko Kamada
Nagoya City University, Japan
kamada@nsc.nagoya-cu.ac.jp

A virtual knot diagram is realized a knot diagram in a closed oriented surface. A diagram of a virtual knot is called checkerboard colorable if a realization in a surface

admits checkerboard coloring. Virtual knots are said to be checkerboard colorable if they have checkerboard colorable diagrams. Classical knots are checkerboard colorable. In this talk we discuss the method of converting a virtual knot diagram to a checkerboard colorable virtual diagram. Then we discuss the invariants derived from the checkerboard colorable diagram obtained by our method.

2010 Mathematics Subject Classification: 57M25, 57M27.
Keywords: virtual knot, checkerboard coloring, invariants of knots.

CT-16. On statistically ϕ-convergence

Supama
Department of Mathematics, Gadjah Mada University, Yogyakarta-Indonesia
supama@ugm.ac.id

Statistical convergence was introduced in connection with problems of series summation. The main idea of the statistical convergence of a sequence (a_n) is that the "majority" of elements from the sequence converge, and we do not care what is going on with other elements.

In this paper, by using the Orlicz function, we introduce a concept of statistical ϕ-convergence, as a generalization of the statistical convergence. Also, we observe some basic properties, the monotonicity, and some topological properties of the statistical ϕ-convergence.

2010 Mathematics Subject Classification: 40A05, 40C05.
Keywords: Orlicz function, ϕ-convergence, density, statistical ϕ-convergence, statistical ϕ-topology.

CT-17. Nielsen fixed point theory on infra-solvmanifolds of Sol

Jang Hyun Jo, Jong Bum Lee
Sogang University, Korea
jhjo@sogang.ac.kr, jlee@sogang.ac.kr

In Nielsen fixed point theory for maps f on closed manifolds M, there are three important homotopy invariants $L(f), N(f)$ and $R(f)$ which are called the Lefschetz, Nielsen and Reidemeister numbers of f, respectively. It is well known that if $L(f) \neq 0$ then any map homotopic to f has a fixed point, and $N(f) \leq \min\{\#\mathrm{Fix}(g) \mid g \simeq f\}$ with equality when $\dim M \geq 3$. Hence $N(f)$ gives better information concerning the existence of fixed points than $L(f)$. However, the computation of $N(f)$ is in general much more difficult than that of $L(f)$ or $R(f)$.

Utilizing the averaging formulas for the Lefschetz, Nielsen and Reidemeister numbers of maps on infra-solvmanifolds of type (R), we compute $L(f), N(f)$ and $R(f)$ of maps f on infra-solvmanifolds of the 3-dimensional solvable Lie group Sol.

2010 Mathematics Subject Classification: 55M20, 57S30.
Keywords: averaging formula, infra-solvmanifold, Nielsen number.

CT-18. On fixed point theorems for new type of φ-contraction in Menger spaces

Vandana Tiwari*, Tanmoy Som
Indian Institute of Technology (Banaras Hindu University), Varanasi-221005, India
vandanpp@gmail.com, tsom.apm@itbhu.ac.in

Very recently, Wang et.el.(FPTA(2015) 2015:201) gave new result on fixed point theorems for φ-contractions in Menger spaces. The results obtained by Wang et. el. improve the corresponding previous results in Menger spaces. In this paper, motivated by these results, we prove some fixed point theorems in Menger spaces by weakening the condition on the function φ.

2010 Mathematics Subject Classification: 47H10,54H25.
Keywords: probabilistic metric space, fixed point, φ-contraction.

CT-19. The class of admissible perturbations of special expressions involving completely monotonic functions

Jerico B. Bacani*, Julius Fergy T. Rabago
Dept. of Math. and Comp. Sci., University of the Philippines Baguio
jicderivative@yahoo.com, jfrabago@gmail.com

In this work, a class $\mathbf{M_2}$ of admissible perturbations of the special expression $\mathbf{M}_0 = \sum_{k=0}^{r} c_k t^{\alpha_k} D_t^{\rho_k}$ in the weighted space $\mathcal{L}^2_\omega([1,\infty))$ will be presented. It will be shown also that the operator $\omega^{\frac{1}{2}}\mathbf{M_2}\omega^{-\frac{1}{2}}$, where ω belongs to the family of completely monotonic functions, is an admissible perturbation of $\mathbf{M}_0$ in the non-weighted space $\mathcal{L}^2([1,\infty))$, and eventually preserves the essential spectrum and nullity of $\mathbf{M}_0$ in that space. As in (Bacani, 2014), our discussion will be limited only to special expressions with $\alpha_1 < \rho_1$.

2010 Mathematics Subject Classification: 47A55, 47B37, 34L05.
Keywords: special expression, admissible perturbations, $\mathcal{L}^2$-space, weighted $\mathcal{L}^2$-space, essential spectrum, nullity, completely monotonic functions.

CT-20. An integration by parts theorem for Kurzweil integrable vector-valued functions via Bochner integration

Tomás Pérez Becerra*, Juan Alberto Escamilla Reyna
Benemérita Universidad Autónoma de Puebla
tompb55@hotmail.com, jescami@fcfm.buap.mx

Kurzweil in 1957 and Henstock in 1961 define, independently, an integral, which is equivalent to the Denjoy-Perron integral for real functions, Cao in 1992 extends this integral to vector-valued functions and gives some properties of this integral. The Bochner integral is a natural extension of the Lebesgue integral to vector-valued functions.

In the framework of vectorial functions, the product of two functions usually is not considered, because a normed space is not equipped, in general, with a product operation as the usual product of real numbers; however, it is possible to introduce a product via a bilinear form. In this sense, the integrability of the product is changed by the integrability of the composition of functions with a bilinear operator. In this talk we present an integration by parts theorem for Kurzweil integrable vector-valued functions via the well-know results of the Bochner integral involving a bilinear bounded operator provided the Banach space has the Radon-Nikodým property, which generalizes some results in integration theory.

2010 Mathematics Subject Classification: 28B05.
Keywords: bilinear operator, Kurzweil integral, Bochner integral, integration by parts, vector-valued functions.

CT-21. The *beta*-dual of the Casaro sequence spaces defined on a generalized Orlicz space

Haryadi*[1,2], Supama[2], Atok Zulijanto[2]
[1]Univ. Muhammadiyah Palangkaraya, [2]Dept. of Math. Universitas Gadjah Mada
haryadi_ump@yahoo.co.id, {supama, atokzulijanto}@ugm.ac.id

In this paper, we introduce the β-dual of the Cesaro sequence space defined on a generalized Orlicz space. Let $\mathcal{L}_\phi$ be a generalized Orlicz space, where the Orlicz function ϕ is convex and satisfies the Δ_2-condition. We define the Cesaro sequence space on $\mathcal{L}_\phi$ as

$$\mathcal{W}_\phi = \left\{ (f_k) \in \omega(\mathcal{S}) : (\exists f_0 \in \mathcal{L}_\phi) \ \frac{1}{N} \sum_{k=1}^{N} \rho_\phi(f_k - f_0) \to 0 \text{ as } N \to \infty \right\},$$

where $\omega(\mathcal{S})$ is the sequence space of measurable functions on $[a, b]$.

The β-dual of $\mathcal{W}_\phi$, denoted by $\mathcal{W}_\phi^\beta$, is defined as follows

$$\mathcal{W}_\phi^\beta = \left\{ (f_k^*) \subset \mathcal{L}_\phi^* : \sum_{k=1}^{\infty} f_k^* f_k \text{ convergens } \forall (f_k) \in \mathcal{W}_\phi \right\}.$$

We show that a sequence $(f_k^*) \in \mathcal{W}_\phi^\beta$ if and only if $\sum_{r=0}^{\infty} 2^r \max_{2^r \le k < 2^{r+1}} \|f_k^*\| < \infty$.

2010 Mathematics Subject Classification: 40A30, 40C05, 40F05.
Keywords: Orlicz function, generalize Orlic space, Cesaro sequence, β-dual.

CT-22. Norm equivalence for generalized Fock spaces and its application to extended Cesàro operators

Hong Rae Cho, Han-Wool Lee, Soohyun Park*
National University, Pusan
chohr@pusan.ac.kr, lhw2725@gmail.com, shpark7@pusan.ac.kr

We consider extended Cesàro operators on generalized Fock spaces which are with the weight replaced by exponential of certain positive functions. The boundedness of extended Cesàro operators is characterized on the Fock spaces with the norm equivalence by Zhangjian Hu in 2013. We prove the analogues on generalized Fock spaces in this research. This result is restricted a case of $p = q = 2$.

2010 Mathematics Subject Classification: 30H20, 47B38.
Keywords: Fock spaces, norm equivalence, extended Cesàro operators.

CT-23. Behavior of two-dimensional competitive system of nonlinear difference equations of higher order

Jerico B. Bacani*, Julius Fergy T. Rabago
Dept. of Math. and Comp. Sci., University of the Philippines Baguio
jicderivative@yahoo.com, jfrabago@gmail.com

We generalize a recent result of Mansour et. al (2012) and study other related systems which deal with the dynamics of a competitive population model described by a system of nonlinear difference equations. More precisely, we consider the system

$$x_{n+1} = \frac{x_{n-(2k-1)}}{\varepsilon + \delta x_{n-(2k-1)}\ y_{n-(k-1)}}, \quad y_{n+1} = \frac{y_{n-(2k-1)}}{\rho + \sigma y_{n-(2k-1)}\ x_{n-(k-1)}},$$

where $\varepsilon, \delta, \rho, \sigma \in \{-1, 1\}$ and $k \in \mathbb{N}$ with real initial conditions $(x_n)_{n=-(2k-1)}^{0}$ and $(y_n)_{n=-(2k-1)}^{0}$ such that $\varepsilon+\delta x_{m-(2k-1)}\ y_{m-(k-1)} \neq 0$ and $\rho+\sigma y_{m-(2k-1)}\ x_{m-(k-1)} \neq 0$ for all possible values of m and k and study the form and behavior of its solutions for all values of $\varepsilon, \delta, \rho$, and σ in $\{-1, 1\}$. This work also generalizes several other results on system of nonlinear difference equations (see (Alghamdi et. al., 2013), (Elsayed, 2012), (Ibrahim and Rabago, 2015), (Kurbanli, 2011), and (Touafek and Elsayed, 2012)). Furthermore, the one-dimensional case of the given system provides a generalization of a series of paper of E. M. Elsayed on nonlinear diffierence equations (see (Elsayed, 2008), (Elsayed, 2009), (Elsayed, 2010) and (Elsayed, 2011)).

2010 Mathematics Subject Classification: 39A10, 39A11.
Keywords: difference equations, competitive system, solution.

CT-24. A norm equivalence for the Fock type mixed norm

Jeongmin Ha*, Hong Rae Cho, Han-Wool Lee
Department of Mathematics, Pusan National University
{jm.ha, chohr}@pusan.ac.kr, lhw2725@gmail.com

In this talk we consider a norm equivalence for the Fock type mixed norm of a holomorphic function and its radial derivative in the n-dimensional complex space. We prove that the mixed norm for an exponential type weighted integral of a holomorphic function is equivalent to the mixed norm of its radial derivative and the distortion function from the weight function in the n-dimensional complex space.

2010 Mathematics Subject Classification: 32A10, 32A36.
Keywords: Bergman spaces, a norm equivalence, a mixed norm of Fock type.

CT-25. Characterizations of sequence of fractional integrable functions

Riyadi, Mardiyana
Department of Mathematics Education, Sebelas Maret University
yadi_laras@yahoo.com, mardiyana@lycos.com

The concept and characterizations of sequence of conventional integrable functions had been studied by some authors, but none of them had discussed about the concept and characterizations of sequence of fractional integrable functions. In this paper, we shall develop its concept and characterize some properties of it. The sequences that shall be developed are monotone convergence theorem, mean convergence theorem and dominated convergence theorem.

2010 Mathematics Subject Classification: 26E40.
Keywords: characterizations, sequence, fractional integrable functions, convergence theorem.

CT-26. On zweier paranorm i-convergent double sequence spaces

Nazneen Khan
Aligarh Muslim University, Aligarh, India
nazneen4maths@gmail.com

In this article we introduce the Zweier Paranorm I-convergent double sequence spaces defined as ${}_2\mathcal{Z}^I(q) = \{x = (x_{ij}) \in_2 \omega : \{(i,j) \in \mathbb{N} \times \mathbb{N} : |Z^p x - L|^{q_{ij}} \geq \epsilon\} \in I,$ for some $L \in \mathbb{C}\}$; ${}_2\mathcal{Z}_0^I(q) = \{x = (xij) \in_2 \omega : \{(i,j)\mathbb{N} \times \mathbb{N} : |Z^p x|^{qij} \geq \epsilon\} \in I\}$; ${}_2\mathcal{Z}_\infty^I(q) = \{x = (x_{ij}) \in_2 \omega : \sup_{i,j} |Z^p x|^{q_{ij}} < \infty\}$. Şengönül, introduced the Zweier sequence spaces $\mathcal{Z}$ and $\mathcal{Z}_0$ as follows $\mathcal{Z} = \{x = (x_k) \in \omega : Z^p x \in c\}$, $\mathcal{Z}_0 = \{x = (x_k) \in \omega : Z^p x \in c_0\}$. We use some new techniques of double sequences and paranorm to construct these new classes of I-convergent double sequences and study some topological properties. We also prove the decomposition theorem and study some inclusion relations on these spaces. New examples have been constructed to support definitions and terms.

2010 Mathematics Subject Classification: 16W25, 16Y30.
Keywords: ideal, filter, I-convergence, I-nullity, paranorm.

CT-27. An inclusion property of Orlicz-Morrey spaces

Al Azhary Masta*, Hendra Gunawan, Wono Setya Budhi
Institut Teknologi Bandung, Indonesia
alazhari.masta@upi.edu, {hgunawan, wono}@math.itb.ac.id

Orlicz-Morrey spaces are generalizations of Orlicz spaces and Morrey spaces. There are two versions of Orlicz-Morrey spaces. One is defined by Nakai in 2004 and another by Sawano, Sugano, and Tanaka in 2012. Here we are interested in studying about the inclusion property of these spaces which were introduced by Nakai. Let Φ be a Young function and $\phi : (0,\infty) \to (0,\infty)$ be nondecreasing and $\frac{\phi(t)}{t}$ be nonincreasing for $t > 0$. The Orlicz-Morrey space $L_{\phi,\Phi}(\mathbb{R}^n)$ is the set of measurable functions $f \in L^1_{loc}(\mathbb{R}^n)$ such that the following

$$\| f \|_{(\phi,\Phi,B(a,r))} := \inf\big\{b > 0 : \frac{\phi(|B(a,r)|)}{|B(a,r)|} \int_{B(a,r)} \Phi\big(\frac{|f(x)|}{b}\big)dx \le 1\big\}$$

is finite for every $a \in \mathbb{R}^n$ and $r > 0$. For $\phi(t) = t$ we have $L_{\phi,\Phi}(\mathbb{R}^n) = L_\Phi(\mathbb{R}^n)$, the Orlicz space. Meanwhile, for $\phi = \frac{1}{\psi}$ (where $\psi : (0,\infty) \to (0,\infty)$ is almost decreasing and $t^{\frac{n}{p}}\psi(t)$ is almost increasing) and $\Phi(t) = t^p$ we have $L_{\phi,\Phi}(\mathbb{R}^n) = \mathcal{M}^p_\psi(\mathbb{R}^n)$, the generalized Morrey space introduced by Nakai in 1994.

Gunawan *et al.* have proved an inclusion property of generalized Morrey spaces: If $1 \le p_1 \le p_2 < \infty$, then $\mathcal{M}^{p_2}_{\psi_2} \subset \mathcal{M}^{p_1}_{\psi_1}$ if and only if $\psi_2(t) \le C\psi_1(t)$ for all $t > 0$. Recently, we have also proved an inclusion property of Orlicz spaces ($L_\Phi(\mathbb{R}^n)$). Let Φ, Ψ be Young functions. Then $L_\Psi(\mathbb{R}^n) \subseteq L_\Phi(\mathbb{R}^n)$ if and only if $\Phi(t) \le \Psi(t)$ for all $t > 0$. In this talk we shall present some necessary and sufficient conditions for inclusion relation between Orlicz-Morrey spaces $L_{\phi,\Phi}(\mathbb{R}^n)$.

2010 Mathematics Subject Classification: 46E30, 46B25, 42B35.
Keywords: inclusion, Orlicz spaces, Morrey spaces, Orlicz-Morrey spaces.

Poster Sessions

P-01. On existence of coincidence and common fixed point for hybrid maps

Anita Tomar
Government P. G. College Dakpathar (Dehradun) Uttarakhand, India
anitatmr@yahoo.com

Hybrid fixed point theory is the realm of common fixed point theorems for contracting single-valued and multivalued maps in metric spaces and has many applications in functional inclusions, optimization theory, fractal graphics and discrete

dynamics for set-valued operators. Aim of this talk is to establish coincidence and common fixed point for discontinuous hybrid quadruple of maps via compatibility without containment requirement of range space?. We also furnish two examples in support of our results.

2010 Mathematics Subject Classification: 34A38.
Keywords: coincidence point, common fixed point, compatible map, hybrid map.

P-02. q-Sumudu transforms of basic generalized hypergeometric functions

V. K. Vyas, Rajshree Purohit
The ICFAI University Jaipur, India
vijaykumarvyas@iujaipur.edu.in, rajshree_purohit@icfaiuniversity.in

The object of this paper is to evaluate q-Sumudu transforms of the basic analogue of H-function of two variables. Interesting special cases of theorems are also discussed. Further, the results proved in this paper may find certain applications of q-Sumudu transforms to the solutions of the q-integrodifferential equations involving functions.

2010 Mathematics Subject Classification: 33C05.
Keywords: q-analogues of Fox's H-function of two variables, q-Sumudu Transform, q-analogues of Meijjer's G-function of two variables.

P-03. On some sequence spaces by using the $(\bar{N}, P_n)$ summability method

T. A. Chishti
University of Kashmir
tachishti@uok.edu.in

The concept of statistical by using $(\bar{N}, P_n)$ summability method was first introduced by Moricz and Orha. We propose to study the sequences spaces which arise due to the concept of $(\bar{N}, P_n)$ summability method. We will be discussing some related results like inclusion relations and also the related generalized results in view of these sequence spaces.

2010 Mathematics Subject Classification: 40A05, 40F05.
Keywords: statistical convergence, $(\bar{N}, P_n)$ summability, weighted statistical convergence.

P-04. Lipschitz conditions and the controlled convergence theorem

Julius V. Benitez, Sandy Mae S. Docdoc
Dept. of Math. and Stat., MSU-Iligan Institute of Technology, Philippines
julius.benitez@g.msuiit.edu.ph, [2]sundaymay.docdoc@gmail.com

The Lebesgue integral is noted for its powerful convergence theorems - the Monotone Convergence Theorem (MCT) and Dominated Convergence Theorem (DCT). These two convergence theorems were proved for the Henstock integral.

Nakanishi and Lee and Yyborny consider yet another but more powerful convergence theorem, called the Controlled Convergence Theorem (CCT), that includes the monotone and dominated convergence theorems. Paredes and Chew studied a controlled convergence theorem for Banach space valued HL-integrals. Generalized absolute continuity (ACG) plays a very significant role in CCT. On the other hand, it is known that if a function satisfies a Lipschitz condition then it is ACG. It is the objective of this study to investigate some Lipschitz conditions in the Controlled Convergence Theorem.

2010 Mathematics Subject Classification: 26A24, 26A06, 26A39, 26A42.
Keywords: Lipschitz condition, ACG^*, controlled convergence theorem.

P-05. Some hyperbolic classes of analytic functions in the unit disk

Luis Manuel Tovar
ESFM, Instituto Politecnico Nacional
tovar@esfm.ipn.mx

We introduce some new hyperbolic classes of analytic functions defined in the unit disk of $\mathbb{C}$, with the aim of generalizing mainly, previous works from Ruhan Zhao and Xianon Li . We give some interesting properties and characterizations in terms of other weighted hyperbolic classes. Besides we give a new characterization of the associated little classes.

2010 Mathematics Subject Classification: 51M09, 11J83.
Keywords: Hyperbolic metric, analytic functions, Bloch functions, Qp-spaces.

P-06. Ramanujan's beautiful results on hypergeometric series and their generalizations

Arjun Kumar Rathie
Dept. of Math., Central University of Kerala, Tejaswini Hills, India
akrathie@cukerala.ac.in

In the theory of generalized hypergeometric series, the classical summation theorems such as those of Gauss, Gauss second, Kummer and Bailey for the series ${}_2F_1$; Watson, Dixon, Whipple and Saalschutz for the series ${}_3F_2$ and others play an important role. Almost all the classical summation theorems for the series ${}_2F_1$, ${}_3F_2$ and others were independently re-discovered by Ramanujan. It is interesting to mention here that whenever the hypergeometric series ${}_2F_1$ reduces to the gamma function, the results are very important from the applications point of view. Professor B.C. Berndt [Ramanujan's Notebooks, Vol. 2, Chapters 10 & 11, Springer-Verlag, 1987] pointed out that the interesting summations due to Ramanujan can be obtained quite simply by employing the above mentioned classical summation theorems.

Professor, W.N. Bailey, in his very popular, interesting and useful research paper [Products of generalized hypergeometric series, Proc. London Math. Soc., (2), 28,

242-254, (1928)] had obtained a large number of very interesting results involving the products of generalized hypergeomettric series(known as well as new) by employing the above mentioned classical summation theorems. Recently, good deal of progress has been done by me and my co-authors [Rakha. M.A., Rathie, Arjun K. :Generalizations of Classical Summation theorems for the series ${}_2F_1$, and ${}_3F_2$ with application, Integral Transforms Spec. Funct.,22(11), 823-840,(2011) and Y.S.Kim, Medhat A. Rakha and A.K.Rathie Extensions of certain classical summation theorems for the series ${}_2F_1$,${}_3F_2$ and ${}_4F_3$ with applications in Ramanujan's summations,309503, 26pages (2010),Int. J. Math. Math. Sc.] in the direction of generalizing the above mentioned classical summation theorems. In this poster presentation, I will present the various results due to Ramanujan including interesting summations and their natural generalization in the most general forms.

2010 Mathematics Subject Classification: 33C20.
Keywords: hypergeometric series, summation theorems, Ramanujan summations.

P-07. A gr*ü*ss type integral inequality associated with pathway fractional integral operator

Sunil Dutt Purohit
Department of HEAS (Mathematics), Rajasthan Technical University, India
sunil.a.purohit@gmail.com

The study of inequalities is an important research subject in mathematical analysis. The inequality technique is also one of the useful tools in the study of special functions and theory of approximations. Therefore, in recent years, by using a variety of fractional integral operators, diverse inequalities have been developed by many authors. In this sequel, here we aim at establishing a generalized fractional integral version of Gr*ü*ss type integral inequality by making use of the pathway type fractional integral operator. Our main result, being of a very general character, is illustrated to specialize to yield numerous interesting fractional integral inequalities including some known results.

2010 Mathematics Subject Classification: 33B15, 33B99, 33C05, 26A33.
Keywords: Gamma function, Gr*ü*ss type integral inequality, pathway fractional integral operator.

P-08. Certain new integral inequalities involving Erd*é*lyi-Kober operator

Naresh Menaria
Department of Mathematics, Pacific college of Engineering, Udaipur-313001, India
naresh.menaria14@gmail.com

In this paper, the Erdélyi-Kober fractional integral operator is used to generate new classes of integral inequalities using a family of n positive functions, ($n \in \mathbb{N}$). Results are expressed in six Theorems. Some special cases in form of remarks of the main results are pointed out. Special cases of the integral operator $I_{\beta}^{\eta,\alpha}$ are also given at the last of paper.

2010 Mathematics Subject Classification: 26A33, 26D10.
Keywords: inequalities, fractional integral operators, Erdélyi-Kober operator.

P-09 Brans-Dicke theory in Gödel type space-time

A. M. Mishra
Department of HEAS, Rajasthan Technical University Kota 324010, India
adm.nita@gmail.com

Considering cylindrically symmetric spacetimes and its a specific case, Gödel spacetime, We study Brans-Dicke theory and find the identities under which deceleration parameter and scalar field can be calculated. As an example we take a particular case of matter dominant universe. More specifically, we show that a constant curvature cylindrically symmetric spacetime must have a scalar field of exponential type in radial and time coordinates.

2010 Mathematics Subject Classification: 83-06, 83D05.
Keywords: Brans Dicke theory, Gödel space time, Hubble constant, deceleration parameter.

P-10. A weak-(p, q) estimate for fractional integral operator on generalized Morrey spaces of nonhomogeneous type

Idha Sihwaningrum
Jenderal Soedirman University, Indonesia
idha.sihwaningrum@unsoed.ac.id

This paper aims to prove a weak-(p, q) estimate for fractional integral operator on generalized Morrey spaces of non homogeneous type when p and q are greater than or equal to one. The proof is found by using a weak-(p, p) estimate for maximal operator and a Hedberg type inequality on the same spaces. The result in this paper is a generalization of the weak-$(1, 1)$ estimate.

2010 Mathematics Subject Classification: 42B20, 26A33, 47B38, 47G10.
Keywords: fractional integral operator, Hedberg type inequality, maximal operator, generalized Morrey spaces, weak estimate.

P-11. Bounds for approximate time and frequency concentration

Louie John Vallejo
Institute of Mathematics, University of the Philippines - Diliman
ldvallejo@math.upd.edu.ph

It is well-known that a function $u \in L^2(\mathbb{R})$ cannot have compact support and be band-limited at the same time. A normalized function u is said to be ε-essentially time- and band-limited on intervals A and B if

$$\int_{\mathbb{R}\setminus A} |u(t)|^2\, dt \;\leq\; \varepsilon^2 \qquad \text{and} \qquad \int_{\mathbb{R}\setminus B} |\widehat{u}(\xi)|^2\, d\xi \;\leq\; \varepsilon^2.$$

For functions that have a jump in a higher-order derivative, we obtain a lower bound for this concentration tolerance ε.

2010 Mathematics Subject Classification: 41A25, 42A16.
Keywords: Fourier transform, approximate concentration, uncertainty principle.

P-12. Ricci solitons on three-dimensional generalized sasakian-space-forms

Shyamal Hui[1], Debabrata Chakraborty[2], Richard Lemence[3]
[1]Department of Mathematics, Bankura University, India
[2]Petadih Hirakhap Jr. High School, India
[3]Institute of Mathematics, College of Science, University of the Philippines-Diliman
shyamal_hui@yahoo.co.in, debabratamath@gmail.com, rslemence@gmail.com

An almost contact metric manifold M equipped with an almost contact metric structure (ϕ, ξ, η, g), where ϕ is a $(1,1)$ tensor field, ξ is a vector field, η is a 1-form and g is a Riemannian metric, is called a Sasakian manifold. In this talk, we will present some results on Ricci solitons in three-dimensional generalized Sasakian-space-forms and we find the conditions of Ricci soliton to be shrinking and expanding when a 3-dimensional generalized Sasakian-space-form metric is a Ricci soliton.

2010 Mathematics Subject Classification: 53C25.
Keywords: Sasakian manifolds, generalized Sasakian-space-form, Ricci soliton, generalized Sasakian-space-form metric.

P-13. Extended Srivastava's triple hypergeometric functions and associated properties

Rakesh K. Parmar
Dept. of Mathematics, Govt. College of Engineering and Technology, India
rakeshparmar27@gmail.com

The main object of this paper is to introduce extended Srivastava's triple hypergeometric functions by using the generalized Pochhammer symbol and investigate certain properties, for example, their various integral representations, Mellin transform, derivative formula, and so on. For each of these extended Srivastava's triple hypergeometric functions, we derive various integral representations involving the Laguerre polynomials, incomplete gamma functions, and the Bessel and modified Bessel functions. Various (known or new) special cases of the results presented here are also considered.

2010 Mathematics Subject Classification: Primary 33B15, 33B20, 33C05, 33C15, 33C20; Secondary 33B99, 33C99, 60B99
Keywords: extended gamma functions, generalized Pochhammer symbol, generalized Gauss hypergeometric function, extended Appell function, Srivastava's triple hypergeometric functions.

P-14. Constructing localized frames adapted to a cover of the time-frequency plane

Gino Angelo Velasco[1], Monika Dörfler[2]
[1]Institute of Mathematics, University of the Philippines Diliman, Philippines
[2]Numerical Harmonic Analysis Group, University of Vienna, Austria
gamvelasco@math.upd.edu.ph, monika.doerfler@univie.ac.at

In processing audio signals, the meticulous separation of signal components in time and frequency is sometimes desired. However, it is known that a nonzero function cannot be compactly supported simultaneously in time and frequency, so that good concentration in one domain would result with increased leakage in the other domain. Due to this trade-off, the design of the window function has been an important issue in signal processing. In this work, we consider time-frequency systems that are adapted to a cover of the time-frequency plane. These systems consist of functions that are optimally concentrated in the regions that form the given cover. This would allow flexibility in the trade-off between the time and frequency resolution in the time-frequency plane. Each locally concentrated system is constructed by projecting local Gabor atoms onto a subspace of eigenfunctions of certain time-frequency localization operators corresponding to each region. We give conditions on when a collection of local time-frequency systems forms a frame for $L^2(\mathbb{R})$. It will then be possible to recover any function $f \in L^2(\mathbb{R})$ from the corresponding time-frequency samples of f. We provide numerical examples that illustrate the concentration of the local Gabor systems in the regions, and some aspects of the frame property of a collection of these local systems.

2010 Mathematics Subject Classification: 42C15, 42C40, 41A30.
Keywords: frames, localization operator, short-time Fourier transform, time-frequency analysis.

S05. Dynamical Systems and Ordinary Differential Equations

Invited Talks

IT-01. A spectral theory of linear operators based on a Gelfand triplet and its application to the dynamics of coupled oscillators

Hayato Chiba
Kyushu University, Japan
chiba@imi.kyushu-u.ac.jp

The Kuramoto model is a system of ordinary differential equations for describing synchronization phenomena defined as a coupled phase oscillators. In this talk, an infinite dimensional Kuramoto model is considered, and Kuramoto's conjecture on a bifurcation diagram of the system will be proved.

A linear operator obtained from the infinite dimensional Kuramoto model has the continuous spectrum on the imaginary axis, so that the usual spectrum does not determine the dynamics. To handle such continuous spectra, a new spectral theory of linear operators based on Gelfand triplets is developed. In particular, a generalized eigenvalue (resonance) is defined. It is proved that a generalized eigenvalue determines the stability and bifurcation of the system.

2010 Mathematics Subject Classification: 37L05.
Keywords: infinite dim dynamical systems, Kuramoto model, spectral theory, Gelfand triplet.

IT-02. Asymptotic stability of linear fractional differential systems with constant coefficients and small time dependent perturbations

Dinh Cong Nguyen*, Thai Son Doan, The Tuan Hoang
Institute of Mathematics, Vietnam Academy of Science and Technology Cau Giay District, 10307 Hanoi, Vietnam
{ndcong, dtson, httuan}@math.ac.vn

Consider the d-dimensional fractional differential equation involving the *Caputo's derivative of order* $\alpha \in (0,1)$:

$$ {}^{C}D^{\alpha}_{0+}x(t) = Ax(t) + f(t, x(t)) \tag{1}$$

with the initial condition $x(0) = x_0$, where $A \in \mathbb{R}^{d\times d}$ is a constant $(d \times d)$-matrix and $f : [0,\infty) \times \mathbb{R}^d \to \mathbb{R}^d$ is continuous such that

$$ f(t,0) = 0 \qquad \text{for all} \quad t \geq 0, \tag{2}$$

and there exists a continuous function $K : [0,\infty) \to \mathbb{R}_+$ satisfying

$$ \|f(t,x) - f(t,y)\| \leq K(t)\|x - y\| \qquad \text{for all} \quad t \geq 0 \quad \text{and} \quad x, y \in \mathbb{R}^d. \tag{3}$$

From (2)–(3) it follows that (1) has unique solution for any given initial value, and $x \equiv 0$ is the trivial solution of (1).

It is well known that the trivial solution of the original unperturbed system (the case $f \equiv 0$) is asymptotically stable if and only if the spectrum $\sigma(A)$ of the matrix $A \in \mathbb{R}^{d\times d}$ (spectrum $\sigma(A)$ is the set of eigenvalues of the matrix A) satisfies the condition

$$\sigma(A) \subset \left\{\lambda \in \mathbb{C} \setminus \{0\} : |\arg(\lambda)| > \frac{\alpha\pi}{2}\right\}. \tag{4}$$

Main result: Assume (4). Then (1) is asymptotically stable in the following cases:

- Uniform small Lipschitz perturbation: $\sup_{t\geq 0} \|K(t)\| < \delta$ for some $\delta > 0$ small enough.
- Decaying Lipschitz perturbation: $\lim_{t\to\infty} \|K(t)\| = 0$.

2010 Mathematics Subject Classification: 34Dxx, 34A30, 26A33.
Keywords: fractional differential equations, linear systems, stability, asymptotic stability.

IT-03. Dynamic behavior of SIR model perturbed by noise

N. H. Du*[1], N. H. Dang[1], N. T. Dieu[2]
[1]VNU-Hanoi University of Science, 334 Nguyen Trai, Thanh Xuan, Ha Noi
[2]Vinh University, 182 Le Duan, Vinh Nghe An

In this talk, we deal with the dynamic behavior stochastic SIR epidemic systems described by the following equation

$$\begin{cases} dS(t) = (\alpha - \beta S(t)I(t) - \mu S)dt + \sigma_1 S(t)dB1(t) \\ dI(t) = (\beta S(t)I(t) - (\mu + \rho + \gamma)I(t))dt + \sigma_2 I(t)dB3(t) \\ dR(t) = (\gamma I(t) - \mu R(t))dt + \sigma_3 R(t)dB3(t), \end{cases}$$

where $B_1(t), B_2(t)$ and $B_3(t)$ are mutually independent Brownian motions, $\sigma_1, \sigma_2, \sigma_3$ are the intensities of the white noises. We give sufficient conditions for the permanence and ergodicity of the solution to the system. The conditions obtained in fact are very close to the necessary conditions. We determine the threshold α that is used to classify the extinction and permanence of the disease. Concretely, $\alpha < 0$ implies that the disease-free $(\frac{\alpha}{\mu}, 0, 0)$ is globally asymptotic stable, i.e., the disease will disappear and the entire population will become susceptible individuals. If $\alpha > 0$ the epidemic takes place. In this case, we derive that the Markov process $(S(t), I(t))$ has an unique invariant probability measure. We also characterize the support of a unique invariant probability measure and prove that the transition probability converges to this invariant measures in total variation norm. Our result is considered as an significant improvement over the results by D. Jiang, P. Xia, *Appl. Math. Comput.*, 236(2014); C.Y. Ji, D.Q. Jiang, N.Z. *Stochastic Anal. Appl*, 30(2012); H. Schurz, and K. Tosun, *J. Dynam. Differential Equations*, 27 (2015).

2010 Mathematics Subject Classification: 65L11, 37A25.
Keywords: SIR model, extinction, permanence, stationary distribution, ergodicity.

IT-04. Closed orbit counting for dyck and motzkin shifts

Mohd Salmi Md Noorani*[1], Fahad Alsharari[1], Habibulla Akhadkulov[2]
[1]Universiti Kebangsaan Malaysia, [2]Universiti Utara Malaysia
msn@ukm.edu.my, fahd331@gmail.com, habibulla@uum.edu.my

In this talk, we present some counting results in the form of sharp estimates for the number of closed orbits for the class infinite type shifts known as Dyck and Motzkin shifts. These estimates are obtained via elementary means and are dynamical analogues of results from classical number theory such as the prime number theorem, Mertens' theorem and Meissel's theorem. Some open problems are suggested at the end of the talk.

2010 Mathematics Subject Classification: 37C25, 37C35.
Keywords: closed orbits, Dyck shifts, Motzkin shifts, estimates.

IT-05. Quantum calculus and applications

Jessada Tariboon
Nonlinear Dynamic Analysis Research Center, King Mongkut's University of Technology North Bangkok, Thailand
jessada.t@sci.kmutnb.ac.th

Quantum calculus (q-calculus) has been introduced in 1910 by Jackson [H.F. Jackson, q-Difference equations, *Am. J. Math.* **32**, (1910) 305-314.] Such calculus appear in several branches of mathematics such as orthogonal polynomials, basic hypergeometric functions, combinatorics, calculus of variations, theory of relativity, hypergeometric series, complex analysis, particle physics and quantum mechanics. In this talk, we give some new concepts of ordinary and fractional of q-derivatives and q-integrals. As applications, initial and boundary value problems of impulsive q-difference equations and also integral inequalities are presented.

2010 Mathematics Subject Classification: 26A33, 26D10, 26D15, 34A08, 34A37, 39A13.
Keywords: quantum calculus, q-derivatives, q-integrals, impulsive q-difference equations, inequalities.

IT-06. Unique solvability of nonlinear partial differential equations of Fuchs type

Jose Ernie C. Lope
University of the Philippines Diliman
ernie@math.upd.edu.ph

We study singular partial differential equations of the form

$$t\partial_t u = f(t, x, u, \partial_x u),$$

where the function $f(t, x, u, v)$ is continuous in t, holomorphic with respect to the other variables, and satisfies $f(0, x, 0, 0) \equiv 0$ and $\partial_v f(0, x, 0, 0) \equiv 0$. Such an equation is said to be a Fuchsian partial differential equation and is a higher dimensional analogue of ordinary differential equations with regular singularities. We show that if $f(t, x, 0, 0)$ tends to zero at a certain rate as $t \to 0$, then the equation has a unique solution that tends to zero at the same rate. We then extend our results to higher order singular equations.

2010 Mathematics Subject Classification: 35A01, 35A10, 35A20.
Keywords: nonlinear, singular, Fuchsian.

IT-07. Analysis of an influenza model with antigenic drift mechanism and the interaction between human and animal population

Fajar Adi Kusumo*[1], Dessy Nurul[1], Muhammad Kharis[2]
[1]Department of Mathematics, Universitas Gadjah Mada
[2]Department of Mathematics, Semarang State University, Indonesia
f_adikusumo@ugm.ac.id, dessynurul@mail.ugm.ac.id, kharis.mat@mail.unnes.ac.id

Influenza A is a type of virus that cause illness in humans. The viral antigen has ability to change gradually (antigenic drift) for producing the virus strains which is the un- derlying causal factor of the influenza epidemic. The antigenic drift mechanism is an antigenic mutation on the skin of the virus. By this mutation, the virus changes its characteristics but do not produce a new strain. We consider a mathematical model of the antigenic drift mechanism infection of the virus in human population combined with infection in animal population. This is motivated by the fact that some of the influenza case can be transferred from the animal to the human population, such as the swine flu. The spreads of the disease related to the interaction between both populations is very important to analyze. In this case we will study the bifurcation of the system related to the variation of the interaction parameter between human and animal populations.

2010 Mathematics Subject Classification: 34C23, 34D10, 92D25, 92D30.
Keywords: influenza, antigenic drift, two populations, interaction parameter.

Contributed Talks

CT-01. On the solution of parameterized second-order boundary value singularly perturbed problem

Ilhame Amirali*[1], Gabil M. Amiraliyev[2]
[1]Dept. of Mathematics, Faculty of Sciences, Duzce University, Turkey
[2]Dept. of Mathematics, Faculty of Arts and Sciences, Erzincan University, Turkey
ailhame@gmail.com, gabilamirali@yahoo.com

In this paper we consider a parameterized singularly perturbed second-order quasilinear boundary value problem. Asymptotic estimates for the solution and its first and second derivatives has been established. The theoretical estimates have been justified by concrete example.

2010 Mathematics Subject Classification: 34K10, 34K26, 34B08.
Keywords: parameterized problem, asymptotic bounds, singular perturbation, boundary layer.

CT-02. Exact multiplicity and bifurcation curves of positive solutions of a one-dimensional Minkowski-curvature problem and its application

Shao-Yuan Huang
Department of Mathematics National Tsing Hua, University Hsinchu 300, Taiwan
syhuang@math.nthu.edu.tw

In this paper, we discuss exact multiplicity and bifurcation curves of positive solutions of the one-dimensional Minkowski-curvature problem

$$\begin{cases} \left[-u'/\sqrt{1-u'^2}\right]' = \lambda f(u), \quad -L < x < L, \\ u(-L) = u(L) = 0, \end{cases}$$

where $\lambda > 0$ is a bifurcation parameter, $L > 0$ is an evolution parameter, $f \in C[0,\infty) \cap C^2(0,\infty)$, $f(u) > 0$ for $u > 0$, and $f''(u)$ is not sign-changing on $(0,\infty)$. Under some suitable hypotheses on $f(u)$ such as condition (H):

(H) For any $\lambda, \alpha > 0$, there exists $\rho = \rho(\alpha, \lambda) \in \mathbb{R}$ such that, for $0 < u < \alpha$,

$$\begin{aligned} H_{\lambda,\rho}(u,\alpha) \equiv\ & \rho B^5\lambda^3 + 5\rho B^4\lambda^2 + B\left(8B^2\rho - 2AB - BC + 3A^2 - AB\rho\right)\lambda \\ & + 4\rho B^2 - 4AB - 2BC + 3A^2 - 2\rho AB > 0, \end{aligned}$$

where

$$A \equiv \alpha f(\alpha) - uf(u),\ B \equiv \int_u^\alpha f(t)dt,\ \text{and } C \equiv \alpha^2 f'(\alpha) - u^2 f'(u),$$

we find that the variation of bifurcation curves on the $(\lambda, \|u\|_\infty)$-plane may have three possibilities: monotone increasing, $\subset$-shaped, and from monotone increasing to $\subset$-shaped with varying $L > 0$. Also, we study, in the $(\lambda, L, \|u\|_\infty)$-space, the shape and structure of the bifurcation surface. Finally, we give an application for this problem with a nonlinear term $f(u) = u^p + u^q$ where $q \geq p > 0$ satisfy some conditions.

2010 Mathematics Subject Classification: 34B15, 34B18, 34C23, 74G35.
Keywords: Minkowski-curvature, bifurcation curve, exact multiplicity, $\subset$-shaped, positive solution.

CT-03. Symmetric solutions in delay-coupled laser networks with all-to-all coupling

Juancho A. Collera
University of the Philippines Baguio
jacollera@up.edu.ph

A network of semiconductor lasers is considered where each laser receives a feedback light from all other lasers in the network. The model is described using the Lang-Kobayashi rate equations where the finite propagation time of the light from one laser to another is reflected by a constant delay time parameter in the laser optical fields. Due to the network structure, the resulting system of delay differential equations has symmetry group $\mathbf{S}_n \times \mathbf{S}^1$. Our result classifies all types of symmetric solutions to the system. This is done by characterizing all isotropy subgroups of the symmetry group $\mathbf{S}_n \times \mathbf{S}^1$. Branches of symmetric solutions, i.e. solutions fixed by isotropy subgroups, are then obtained using DDE-Biftool. The results of this research complement the author's previous work, in the same laser network with all-to-all coupling, which identifies symmetry-breaking bifurcations along the branch of fully symmetric solutions.

2010 Mathematics Subject Classification: 37G15, 37G40, 37N20.
Keywords: Lang-Kobayashi rate equations, symmetry, semiconductor laser, networks.

CT-04. Washout and non-washout solutions of a microbial fermentation model under the influences of growth inhibitions and maximal cell density

Kasbawati*[1], Agus Yodi Gunawan[2], Kuntjoro Adjie Sidarto[2]
[1]Department of Mathematics, Hasanuddin University, Indonesia
[2]Industrial & Financial Math. Research Group, Institut Teknologi Bandung
kasbawati@unhas.ac.id, {aygunawan, sidarto}@math.itb.ac.id

An unstructured model for the growth of yeast cell on glucose is discussed. Growth inhibitions by substrate, product, and cell density as natural phenomena for cell growth are taken into consideration. The proposed model describes the dynamical behavior of fermentation system that reveals multiple steady states and oscillatory behavior in a certain regime of operating parameters. Two types of steady state solution are found, namely washout and non-washout solutions.

There exists a certain pair of inlet glucose and dilution rate values at which the washout solution may be avoided. For the non-washout solution, three regimes for its stability behavior are found: regime with unique stable steady state, unique stable steady state with oscillatory behavior, and regime with multiple steady states and possible oscillatory behavior. High carrying capacity expands the non-washout steady state domain with and without oscillatory behavior. There is an optimal inlet glucose which produces the highest cell and ethanol concentration. There is also a critical inlet glucose at which feeding glucose which is greater than the critical one leads the system to the washout solution.

2010 Mathematics Subject Classification: 92C45, 34K60, 34K99, 34K18.
Keywords: continuous fermentation system, growth inhibitions, carrying capacity, multiplicity, bifurcation analysis.

CT-05. Social and economic influences on human behavioural response in an emerging epidemic

Piau Phang*[1,2], Yong-Hong Wu[1], Benchawan Wiwatanapataphee[1]
[1]Dept. of Mathematics and Statistics, Curtin University, Perth, Australia.
[2]Dept. of Comp. Sci. and Math., Universiti Malaysia Sarawak, Malaysia.
pphang@fit.unimas.my, {Y.Wu, b.wiwatanapataphee}@curtin.edu.au

The human behavioural changes have been recognised as an important key in shaping the disease spreading and determining the success of control measures in the course of epidemic outbreaks. However, apart from cost-benefit considerations, in reality, people are heterogeneous in their preferences towards adopting certain protective actions to reduce their risk of infection, and social norms have a function in individuals' decision making. Here, we studied the interplay between the epidemic dynamics, imitation dynamics and the heterogeneity of individual protective behavioural response under the considerations of both economic and social factors, with a simple mathematical compartmental model coupled with multi-population game dynamical replicator equations. We assume that susceptibles in different subpopulations have different preferences in adopting either normal or altered behaviour. By incorporating both intra- and inter-group social pressure, the outcome of the strategies distribution depends on the initial proportion of susceptible with normal and altered strategies in both subpopulations. The increase of additional cost to susceptible with altered behaviour will discourage people to take up protective actions and hence results in higher epidemic final size. For a specific cost of altered behaviour, the social group pressure could be a double edged sword, though. We conclude that the interplay between individual protective behaviour adoption, imitation and epidemic dynamics are necessarily complex if both economic and social factors act on populations with existing preferences.

2010 Mathematics Subject Classification: 92D25, 37N25.
Keywords: epidemic modelling, imitation dynamics, social and economic factors, intra- and inter-group pressure.

CT-06. Evolutionary bifurcation curves for the one-dimensional perturbed Gelfand problem from combustion theory and a variational property

Shin-Hwa Wang, Shao-Yuan Huang
Dept. of Mathematics, National Tsing Hua University, Hsinchu 300, Taiwan
{shwang, syhuang}@math.nthu.edu.tw

We study global bifurcation curves and the exact multiplicity of positive solutions for the two-point boundary value problem arising in combustion theory

$$\begin{cases} u''(x) + \lambda \exp\left(\frac{au}{a+u}\right) = 0, & -1 < x < 1, \\ u(-1) = u(1) = 0, \end{cases} \tag{1}$$

where $\lambda > 0$ is the Frank–Kamenetskii parameter and $a > 0$ is the activation energy parameter. We prove that there exists $a_0 \approx 4.069$ such that, on the $(\lambda, \|u\|_\infty)$-plane, the bifurcation curve for (1) is S-shaped on the $(\lambda, \|u\|_\infty)$-plane for $a > a_0$ and is monotone increasing for $0 < a \leq a_0$. That is, we prove the long-standing conjecture for the one-dimensional perturbed Gelfand problem. We also study, in the $(a, \lambda, \|u\|_\infty)$-space, the shape and structure of the bifurcation surface. Finally, we study a variational property on the evolutionary bifurcation curves for (1).

2010 Mathematics Subject Classification: 34C23.
Keywords: positive solution, exact multiplicity, turning point, S-shaped bifurcation curve.

CT-07. Existence of maximal bounded attractor for the Lorenz system

Naimah Aris*, Jihan Fazlika, Agustinus Ribal
Mathematics Department, Hasanuddin University, Indonesia
{newima, fazlika.jihan, agus.ribal}@gmail.com

This paper analyzes the existence of maximal bounded attractor for the Lorenz system. In the initial stage we prove the solution of the Lorenz equations are bounded in t approaches infinity. Then take a bounded set B_i of $B(0, R)$ and choose an open set $B(0, \rho)$ in norm space which contains bounded solutions of the Lorenz equations. After that we operate operator continuous semigroups $T(t)$ on any bounded set B_i and on the set $B(0, \rho)$. The results of the operation will be referred as an attractor if and only if any $T(t)B_i$ absorbed by $B(0, \rho)$. If the intersection from closure union $T(t)B_i$ called the ω-limit set of B, attracts the bounded set of $B(0, \rho)$ (called compact attractor), then the existence of maximal bounded attractor for the Lorenz system proven to exist.

2010 Mathematics Subject Classification: 37C70, 34D45, 35B41.
Keywords: maximal bounded attractor, Lorenz system, strongly continuous semigroups.

CT-08. Topological entropy and its application on the entropy of DNA sequences

Widodo
Department of Mathematics, Gadjah Mada University, Yogyakarta, Indonesia
widodo_math@ugm.ac.id

Dynamical systems (DS) is a process that changes to the variables of time, and it can occurs in many science. For example, the movement of the planets, weather, stock market, and chemical reaction. It also occurs in the iteration process as in fractal geometry, cellular automata, and cryptography. It is known to have two types of DS, i.e. continuous and discrete DS. Continuous DS typically formulated in the form of systems of differential equations, while the discrete DS (DDS) is usually formulated in the form of a systems of difference equations and iteration functions on a metric space.

Topological entropy (TE) of DDS is a non-negative real numbers that measure system disorder. TE was first introduced by Adler, et al (1965) using open cover. It can be interpreted that the TE represents exponential growth of a number of different orbit of an iteration. In the subsequent development of a deeper discussion about the TE can be read in the works Walters (1982), Block and Coppel (1992), Profanter (1995), and Widodo (2003). The relationship between the TE of a piecewise linear function and not continuous on the interval [0,1] with the TE of shift function on the symbols sequences space have been investigated by Widodo (2002).

Most living organisms have genes encoded in strands / long strands of DNA (deoxyribonucleic acid). DNA consists of a sequence which is composed of four types of nucleotide subunits (nucleotide), i.e. A = Adenine, C = cytosine, G = guanine, and T = thymine. Each nucleotide sub-unit consists of phosphate group, deoxyribose sugar ring and the nucleobase. Normally A, C, G, and T are called DNA bases.

One of the chemical structure of DNA is the famous double helix. The construction of the double helix can be found for example in Klavinson et al (2005). DNA sequences include biochemical methods for determining the nucleotide base sequence that is Adenine, Cytosine, Guanine, and Thymine. Naturally A always pairs with T, while the G always with C. In this paper, we will present the concept of topological entropy and its application on the entropy of DNA sequences space of organisms.

2010 Mathematics Subject Classification: 37B40, 37A35.
Keywords: discrete dynamical systems, topological entropy, DNA, double helix.

CT-09. Dynamical analysis of a delayed SIR epidemic model with vaccination

Trisilowati*, I. Darti, S. Fitri
Mathematics Department, Brawijaya University, Indonesia
{trisilowati, isnanidarti, saadatulfitri}@ub.ac.id

In epidemiological studies, many diseases such as diphtheria, influenza and measles, have a latent or incubation period. To include this effect in mathematical model, we introduce a time delay into susceptible and infective individuals. Moreover one of the strategy in controlling the spread of the diseases is by vaccination. When susceptible individual is vaccinated also there is a time delay until they become immune to a disease. In this paper, we formulate a delayed SIR epidemic model by introducing a time delay into susceptible and infective individuals in incidence rate as well as into susceptible in vaccination rate. In this case we assume that both of the time delay have the same period. Furthermore, we analyze the stability of equilibrium points and prove the existence of Hopf bifurcation. Based on analysis result, we found that if basic reproduction number, R_0, is less than one, the disease free equilibrium is locally asymptotically stable. However, if R_0 is greater than one the endemic equilibrium is locally asymptotically stable. Finally, some numerical simulations are presented to illustrate the analysis result.

2010 Mathematics Subject Classification: 37G15, 92B05.
Keywords: delayed differential equation, Hopf bifurcation, SIR model, vaccination.

CT-10. On global stability of equilibria of HIV spread mathematical model among injecting drug users including methadon therapy

Windarto
Dept. of Math. Faculty of Science and Technology, Universitas Airlangga
windarto@fst.unair.ac.id

Early deterministic mathematical model of HIV spread among injecting drug users (IDU) was developed by Kaplan (1989). The model from Kaplan was in the form two dimensional system of ordinary differential equations. The first one described the dynamic of probability an IDU to be exposed to HIV after using after using contaminated needles. The second one described dynamic of the IDU fraction to be infected by HIV. Then, Greenhalg and Hay (1997) extend the Kaplan model by considering some realistic assumption. Then, Nuraini et al. (2011) extend the model from Greenhalgh and Hay by considering methadone therapy program. The mathematical model from Nurani et al. consist of three dimensional system of ordinary differential equation. The model has two equilibria, namely disease-free equilibrium and endemic equilibrium. By constructing suitable Lyapunov function, we show that the disease free equilibrium is globally asymptotically stable whenever the basic reproductive ratio is less than one. Moreover, we show that the endemic equilibrium is globally asymptotically stable whenever the basic reproductive ratio is more than one.

2010 Mathematics Subject Classification: 37C75, 34D23, 93D05.
Keywords: mathematical model, HIV, injecting drug user, basic reproductive ratio, Lyapunov function.

CT-11. Fractal analysis to classify heart sound recordings (phonocardiogram) using Higuchi algorithm

Dhiah Wardani, Dwi Juniati
Department of Mathematics, Universitas Negeri Surabaya
dhiahekakusuma@gmail.com, dwi _juniati@yahoo.com

Heart disease is a number one killer disease in the world. One way to overcome this problem is to detect early abnormalities in a person's heart. Abnormalities heart can be detected from heart sound. The technique used is auscultation, i.e listening heart sounds using a stethoscope. The downside of this technique is the accuracy of the analysis depends on the sensitivity of the ears and the experience of an expert in distinguishing between an abnormality and normal heart sound, so that the diagnosis is still influenced by the subjectivity of the physician. To overcome these problem, it has been developed a method for the detection of heart disease using phonocardiogram analysis (recordings of heart sounds).

In this paper, we present about implementation of fractal analysis to make a classification of phonocardiographic recording into normal heart sound, murmur, and extra systole. The main algorithm used here is Higuchis Algorithm to calculated fractal dimension values. There are two step in classification phonocardiographics recording, feature extraction and classification. In feature extraction, we used Discrete Wavelet Transform to filtered the signal from noise and Neural Network for classification. Discrete Wavelet Transform decomposition generates signals called sub band. Detail coefficients of decomposition are then conducted threshold process and reconstructed to obtain the original signal from the noise called denoised signal. From denoised signal then fractal dimension values is calculated and that value will be addressed by using a neural network to classify a phonocardiogram.

2010 Mathematics Subject Classification: 68U05, 65D18, 68W40.
Keywords: phonocardiography, discrete wavelet transform, fractal dimension, Higuchi algorithm.

CT-12. Controlling spatial spreading of MERS disease with medical support

S. Rozi*[1,2], D. Aldila[1], H. Tasman[1]
[1]Department of Mathematics, FMIPA, Universitas Indonesia
[2]Department of Computer Science, STIKOM Dinamika Bangsa, Jambi
{syamsyida.rozi, aldiladipo, htasman}@sci.ui.ac.id

In June 2012, a kind of coronavirus, which latter is known as MERS-CoV, was identified from a man in Saudi Arabia. Since then, that kind of virus spread quickly to the countries in and neighboring the Arabian Peninsula and to several other countries in the world. In this article, a model that involve camel and

human population is proposed to analyze the magnitude of basic reproduction number ($\mathcal{R}_0$) as indicator of epidemic, analyze the speed of MERS propagation and analyze the effect of diffusion movements in infected people with respect to the speed of MERS propagation spatially. The existence of equilibrium point and their local stability are affected by $\mathcal{R}_0$ which is obtained from spectral radius of the next-generation matrix. By analyzing the spatial model, we find the minimum speed of MERS propagation which connect the disease free equilibrium to endemic equilibrium point. That result is performed as traveling wave solution by numerical simulation with finite difference approach. Analyzing $\mathcal{R}_0$, we find that MERS propagation can be minimized effectively by doing an intervention through medical support and restricting the movement of infected people.

2010 Mathematics Subject Classification: 92D25, 92D30, 35Q92.
Keywords: MERS, spatial model, basic reproduction number, traveling wave solution, minimum speed.

CT-13. Relation between mosquito behavior and malaria transmission dynamics

Sungchan Kim*, Giphil Cho, Il Hyo Jung
Dept. of Mathematics, Pusan National University, Korea
{sungchan, giphil, ilhjung}@pusan.ac.kr

In 2005, Lacroix et.al. demonstrated that infected humans are more attractive to the mosquitos and we call this phenomenon a *vector-bias effect*. The aims of this talk are verifying how and why a vector-bias effect affects i) the changes of dynamics in malaria transmission, especially the endemic-size and ii) the changes of control-effectiveness for optimal control and its execution costs in the different transmission rates considering the effect of the regional characteristics or force of infections in different areas. We paid attention to showing the results in between two areas: one is high transmission area and the other is low transmission area. ODE analysis and optimal control theory are used to engage in our work.

2010 Mathematics Subject Classification: 34D20, 34D23.
Keywords: malaria transmission dynamics, a vector-bias effect, endemic-size, low transmission area, high transmission area, sensitivity analysis, optimal control, cost-effectiveness.

CT-14. Dynamical study for dengue epidemiological model: an analysis of intervention

D. Aldila*, A. Yuwanda
Department of Mathematics, FMIPA, Universitas Indonesia
{aldiladipo, alethea.yuwanda}@sci.ui.ac.id

Mathematical model of dengue disease transmission will be discussed in this article. Various intervention that already done or still in progress by the government

will be considered, such as mass (u_1) and new born (u_2) vaccination to human population, fumigation (u_3) and temephose (u_4) intervention to mosquitoes population and mechanical intervention (promoting healthy environment) (u_5).

Deterministic approach in 7 dimensional system was developed involving 4 and 3 dimensional system for human and mosquitoes population, respectively. Four equilibrium points have been found. Existence criteria and local stability for disease free and endemic equilibrium points were analyzed. We find that the disease free equilibrium point (condition when no more infected population exist) will locally stable if and only if the basic reproductive ratio ($\mathcal{R}_0$) is smaller than 1. Basic reproductive ratio is defined as expected number of secondary cases according to one primary case in virgin population during an infection period [Diekmann, 2000], and $\mathcal{R}_0$ for our model is given by

$$\mathcal{R}_0 = \frac{b^2\beta_h\beta_5 u_5 k\left((1-u_2)\mu_h + \theta_h + \xi\left(u_1 + u_2\mu_h\right)\right)\left(\mathcal{R}_1 - 1\right)}{\phi\left(\gamma_h + \mu_h\right)\left(u_1 + \mu_h + \theta_h\right)\left(\mu_v + u_4\right)^2}$$

with $\mathcal{R}_1 = \frac{\phi\,\eta_v}{(\mu_v+u_4)(\mu_v+u_3+\eta_v)}$, b is mosquitoes biting rate, β is infection rate, u_i are intervention parameters, θ is human recruitment rate, μ is death rate and γ_h is recovery rate. Sensitivity analysis of $\mathcal{R}_0$ respect to intervention parameters also will be shown in this article. We find that, direct intervention to mosquitoes population is much better to reducing dengue spread rather than intervention to human population with vaccine scenario. Some numerical simulation for various scenario (preventing and reduction strategy) will be given to give a better understanding about the result.

2010 Mathematics Subject Classification: 34B60, 92D25, 92D30.
Keywords: dengue, vaccination, fumigation, temephose, mechanical intervention, basic reproductive ratio.

CT-15. ODE and SDE model of cancer viral therapy: how do we avoid failure of cancer viral therapy?

Kwang Su Kim*[1], Il Hyo Jung[1], Sangil Kim[2]
[1]Department of Mathematics, Pusan National University, Busan, South Korea
[2]WISE Institute, Hankuk University of Foreign Studies, 156-849, South Korea
{kwangsu, ilhjung}@pusan.ac.kr, sikim@hufs.ac.kr

Recently, cancer virotherapy, or anti-tumor virus therapy has been studied in mathematical modeling for more successful elimination of tumors. Various oncolytic viruses are currently used for cancer therapy, and virus selection would be an important topic of investigation. This study aims to construct mathematical models that can provide a guide to oncolytic virus selection for the more effective virotherapy.

To do so, we first constructed an ordinary differential equation (ODE) that describes cancer virotherapy mechanism,and derived global asymptotically stable

condition of therapy failure equilibrium. Then, a stochastic differential equations (SDE) is derived to characterize the features of oncolytic virus. By using basic reproductive ratio, we investigate its sensitivity to the parameter values about characteristics of viruses and explore probability of uninfected tumor and infected tumor extinction depends on changing parameter values. Numerical results suggest that we need virus which have high infection rate and optimal cytotoxicity for effective treatment.

2010 Mathematics Subject Classification: 34D05, 34D23, 34F05, 92D25, 92C50.
Keywords: cancer-viral therapy, basic reproduction ratio, deterministic differential equation, stochastic differential model.

CT-16. Analysis of a model of the spread of radical ideology with some results of rehabilitation program

Hengki Tasman*, Bevina D. Handari
Departemen Matematika, Universitas Indonesia
{htasman, bevina}@sci.ui.ac.id

Radical ideology has appeared in many places recently. Many peoples are involved in the spread of the ideology actively. The radical ideology is often followed by destructive actions. Hence, the spread should be controlled. People with radical ideology should be deradicalized. Unfortunately, deradicalization program has various results.

We formulate a model to measure the various results of the program to population. The population is partitioned into four classes, as the general class S, the low-radical class F_1, the high-radical class F_2 and the rehabilitation class P. We use following transmission diagram for the model. The model uses a four dimensional system of differential equations.Here, we give detailed analysis of the model, including the stability analysis and the bifurcation analysis.

2010 Mathematics Subject Classification: 34C23, 34D05, 34D20, 34D23, 91D10.
Keywords: mathematical model, radical ideology, bifurcation analysis, stability analysis.

CT-17. Dynamic of SIR-E rotavirus epidemic model

Isnani Darti*, Agus Suryanto, Trisilowati
Department of Mathematics, Brawijaya University, Indonesia
{isnanidarti, suryanto, trisilowati}@ub.ac.id

Rotavirus is the most common cause of severe gastroenteritis in infants and young children worldwide. Rotavirus spreads easily especially among infants. In this paper, we consider a mathematical model for rotavirus transmission. The model is a generalization of the Susceptible-Infected-Recovered and Environment pathogen (SIR-E) epidemic model. The generalization is performed by including the death rate of infective human population induced by the disease and assuming that the pathogen can grow in environment. The derived model is dynamically

analyzed by first determining the equilibrium point of the model. The basic reproduction number (R_0) is then derived using the next generation matrix. It is found that there exists a disease-free equilibrium which is locally asymptotically stable when $R_0 < 1$, and is unstable when $R_0 > 1$. If $R_0 > 1$, the model also has an endemic equilibrium which is asymptotically stable. We illustrate our analytical results by performing some numerical simulations.

2010 Mathematics Subject Classification: 37N25, 92D30.
Keywords: rotavirus, epidemic model, next generation matrix, stability analysis.

CT-18. The stability of the dispersionless complex Swift-Hohenberg equation

Nur Izzati Khairudin*, Farah Aini Abdullah, Yahya Abu Hasan
School of Mathematical Sciences, Universiti Sains Malaysia, Penang, Malaysia
nik12_mah028@student.usm.my, {farahaini, ah.yahya}@usm.my

The complex Swift-Hohenberg equation (CSHE) models for looking at various aspects of pattern formation and it is the generic equation that relate to a wide variety of disciplines especially in dissipative phenomena in physics. We perform an investigation of the stability of the fixed points of the dispersionless CSHE. The CSHE itself is treated in a new way where we destabilize the dispersion parameter in the CSHE. The fact that dispersion and nonlinearity in dissipative systems must be balanced in order to produce stationary solutions, we take into account that the dispersion parameter is closed to zero. Thus, this system depends on nonlinearity since the dispersion essentially have no effect to the system. A modified variational formulation and geometric method are applied to analyze the fixed points. The observed Jacobian eigenvalues and trajectories constitute the periodicity in the phase space. Our predictions on the variation of soliton amplitude, phase of the pulse and width with the CSHE parameters agree with the simulation results.

2010 Mathematics Subject Classification: 37L15, 35Q56, 35Q60.
Keywords: complex Swift-Hohenberg equation, dissipative solitons, dispersion, nonlinear PDE.

CT-19. Moment analysis of the stochastic Morris-Lecar neuron with additive noise

Syed M. Raza Shah Naqvi*, Hyun Min Kim
Department of Mathematics, Pusan National University, Busan, South Korea
{raza, hyunmin}@pusan.ac.kr

In this paper, an analytical method is presented to determine the response of a neuron, represented by systems of nonlinear ordinary stochastic differential equations - the Morris-Lecar (ML) system with Gaussian white noise. From this system five differential equations for the means, variances, and covariance of the two components were obtained. The probability that a neuron is emitting an action potential at any given time can be estimated by these quantities. All the simulations were made by using MATLAB and the differential equations are solved by

using Rung-Kutta numerical method. We also performed simulations on differential equations for low, medium, and high noise and compared the results with the simulations of the stochastic system. Thus, we can conclude that the presented analytical method will have a good application for single neuron and can also be extended for the network of ML neurons. Additionally, the presented analytical method is expected to be useful for computational studies of information processing.

2010 Mathematics Subject Classification: 92B05, 92B20, 65L06, 60H10, 60H35.
Keywords: Morris-Lecar model, stochastic neuron, moment method, noise.

CT-20. A mathematical model of transmission of rice tungro disease by nephotettix virescens

Nikki T. Blas*[1], Joel M. Addawe[2], Guido David[1]
[1]University of the Philippines - Diliman, [2]University of the Philippines - Baguio
nikkitagabiblas@yahoo.com, jmaddawe@up.edu.ph, gdavid@math.upd.edu.ph

Rice tungro disease is described as cancer due to its major impact to the livelihood of farmers and the difficulty of controlling it. Tungro is a semi-persistent virus transmitted by green leafhoppers called *Nephottetix Virescens*. In this paper, we presented a compartmental plant-vector model of the *Nephottetix Virescens* - rice plant interaction based on a system of ordinary differential equations to simulate the effects of roguing in controlling the spread of Tungro virus in a model rice field. The system was analyzed for the stability of equilibrium solutions, existence of endemic solutions and solved numerically for susceptible rice varieties (Taichung Native 1).

2010 Mathematics Subject Classification: 65Lxx, 39Axx.
Keywords: rice tungro disease, endemic, roguing, ordinary differential equations, compartmental models, dynamical systems.

CT-21. Direction of Hopf bifurcation for a predator-prey model with two time delays

May Anne C. Tirado*[1], Polly W. Sy[1], Lorna S. Almocera[2]
[1]University of the Philippines - Diliman, [2]University of the Philippines - Cebu
{mayang.tirado, pweesy}@gmail.com, lsalmocera@yahoo.com

We study the predator-prey model with two time delays,

$$\begin{aligned} \frac{dx(t)}{dt} &= x(t)\left[1 - k_1 x(t) - k_2 x^2(t)\right] - y(t-\tau_1)\frac{x(t)}{1+ax(t)} \\ \frac{dy(t)}{dt} &= y(t)\left[-\delta_0 - \delta_1 y(t) + \gamma\frac{x(t-\tau_2)}{1+ax(t-\tau_2)}\right], \end{aligned} \tag{1}$$

where x and y represent the prey and predator densities respectively. With $\tau_1 > 0$ as the hunting time delay, and $\tau_2 > 0$ is the delay due to gestation. We assume the

initial conditions

$$(x(\theta), y(\theta)) = (\Phi_1(\theta), \Phi_2(\theta)) \in C([-\tau_M, 0], \mathbb{R}^2_+) \quad x(0) > 0, \quad y(0) > 0 \tag{2}$$

where $\tau_M = \max\{\tau_1, \tau_2\}$ and $\mathbb{R}^2_+ = \{(x, y)|\ x > 0,\ y > 0\}$. We use $\tau = \tau_1 + \tau_2$ as the bifurcation parameter, and prove that if the positive equilibrium $E^* = (x^*, y^*)$ is stable for $\tau = 0$, the system (1) undergoes Hopf bifurcation. Using the Center Manifold Theorem, and the technique used in the book of Hassard and Kazarinoff (1981), we determine the direction of bifurcation, and the stability and period of the limit cycles. Numerical simulations are presented to illustrate the results.

2010 Mathematics Subject Classification: 34K18, 37J20.
Keywords: delay differential equations, predator-prey model, Hopf bifurcation, center manifold theorem.

CT-22. The dynamical system of a bank using interbank lending market

Novriana Sumarti*, Akmal Fadhlurrahman
Institut Teknologi Bandung, Indonesia
novriana@math.itb.ac.id

The model of dynamic system of a bank is constructed in order to understand the nature of a bank so that it can be observed behavior in the future. This model is included the interbank lending market which is the part of bank's portfolio management. The analysis on the equilibrium points of the system is done and the interpretation of the result is analysed to see the effects on the dynamics of equity. The models is implemented on real data of Indonesian banking. The result shows that the bank will be stable and secure in the long run if it has a different portfolio management using interbank lending market responsing to the dynamics of equity and liquidity. The bank will be stable and safe when there is an increase of the third party funds in conjunction with the growth of the equity, and an increase of lending in conjunction with the growth of liquidity.

2010 Mathematics Subject Classification: 34D20, 34C25, 91B62.
Keywords: interbank lending market, portfolio management.

CT-23. New delay-range-dependent stability criteria for linear system with non-differentiable interval time-varying delay and nonlinear perturbations

Presarin Tangsiridamrong*, Kanit Mukdasai
Department of Mathematics, Faculty of Science, Khon Kaen University, Thailand
presarin.t@kkumail.com, kanit@kku.ac.th

In this paper, we investigate the problem of delay-range-dependent stability analysis for linear system with interval time-varying delay and nonlinear perturbations. The restriction on the derivative of the interval time-varying delay is removed, which means that a fast interval time-varying delay is allowed. The method

combining descriptor model transformation, Leibniz-Newton formula, improved integral inequalities, utilization of zero equation and new Lyapunov-Krasovskii functional has been adopted to study. New delay-range-dependent stability criteria for considered system are established in terms of linear matrix inequalities (LMIs). A numerical example has shown significant improvement over some existing results.

2010 Mathematics Subject Classification: 37B25, 37C75.
Keywords: stability, linear system, linear matrix inequality, Lyapunov method, descriptor model transformation.

CT-24. Existence of positive solutions for nonlinear fractional differential equations

Jinsil Lee*, Yong-Hoon Lee
Department of Mathematics, Pusan National University
{js3716, yhlee}@pusan.ac.kr

In this talk, we introduce an existence result of positive solutions for nonlinear fractional differential equation with a singular weight. Consider the following fractional nonlinear differential equation

$$\begin{cases} D^{\alpha}_{0+}u(t) + h(t)f(u(t)) = 0, \quad t \in (0,1), \\ u(0) = 0 = u(1), \end{cases} \tag{E}$$

where D^{α}_{0+} is the Riemann-Liouville fractional derivative of order α, $\alpha \in (1,2]$, $h \in L^1_{loc}(0,1)$ and $f \in C([0,\infty),[0,\infty))$. Moreover h satisfies the following condition

$$(H) \qquad \int_0^1 s^{\alpha-1}(1-s)^{\alpha-1}h(s)ds < +\infty.$$

There have been vast amount of literatures about existence of positive solutions when h is in $L^1(0,1)$. However we are interested in the case when h may not be in $L^1(0,1)$. For this, we first set up the Green function and derive corresponding integral operator of (E) and then examine compactness of the operator. As an application, we prove the existence of a positive solution for problem (E) about two types of nonlinearities; superlinear type and sublinear type.

2010 Mathematics Subject Classification: 34B16, 34B18.
Keywords: fractional differential equation, positive solution, existence, singular weight.

CT-25. Imploding cylindrical and spherical shock waves in a non-ideal gas

Amit Tomar[1], Rajan Arora[2], V. P. Singh[3]
[1]Amity University Noida, India, [2]Indian Institute of Technology Roorkee, India
[3]Maths Deptt., Faculty of Science, Al- Baha university, Al-Baha Saudi Arabia
amitmath.14@gmail.com, rajanfpt@iitr.ac.in, singhvp3@gmail.com

Strong cylindrical and spherical shock waves, collapsing at the center (or axis) of symmetry,are studied for a non-ideal gas. The perturbation technique applied

in this paper provides a global solution to the implosion problem yielding the results of Guderley's local self-similar solution, which is valid only in the vicinity of the center/axis of implosion. The similarity exponents are found along with the corresponding amplitudes in the vicinity of the shock collapse. The flow parameters and the shock trajectory have been computed for different values of the adiabatic coefficient and the non-ideal parameter. The graphs of the flow variables at the rear of the shock wave are presented.

2010 Mathematics Subject Classification: 76L05.
Keywords: shock waves, convergence, implosion problem, non ideal gas.

CT-26. Limiting behavior in a five-species chemostat model with parasitic fungi

Alexis Erich S. Almocera*[1], Sze-Bi Hsu[2], Polly W. Sy[1]
[1]Institute of Mathematics, University of the Philippines Diliman
[2]Department of Mathematics, National Tsing Hua University, Taiwan
alalmocera@gmail.com, sbhsu@math.nthu.edu.tw, pweesy@gmail.com

We consider a chemostat model formulated by Takeshi Miki, Gaku Takimoto and Maiko Kagami. This model describes the exploitative competition of two phytoplankton groups, where the large phytoplankton is infected by *parasitic fungi*. In addition, an omnivore zooplankton feeds on both the small phytoplankton and fungi. We discuss the global dynamics of this model with a view on survival and extinction. By applying the methods of *persistence theory*, we determine conditions where a given species survives (uniformly persists), and conclude that the model predicts coexistence.

2010 Mathematics Subject Classification: 92D25, 92D40, 34D05.
Keywords: chemostat model, parasitic fungi, limiting behavior, persistence.

CT-27. New approach for the existence of global attractor in the Lorenz system

Naimah Aris
Mathematics Department, Hasanuddin University, Indonesia
newima@gmail.com

In this paper, we construct conditions for the existence of global attractor in the Lorenz system using the measure of noncompactness property. The Lorenz system can be described by a strongly continuous semigroup generated in infinite dimensional spaces and the existence of the global attractor can be shown by uniformly compact semigroup. In this research, we derive conditions which are not only weaker than the uniformly compact condition but also easier to verify in the Lorenz system. The results show that the Lorenz system has the global attractor if and only if there exist an absorbing set which contain all bounded solutions of

the system and the semigroup satisfies the measure of noncompactness property in a convex Banach spaces.

2010 Mathematics Subject Classification: 37C70, 34D45, 35B41.
Keywords: global attractor, Lorenz system, measure of noncompactness.

CT-28 Multi-step method for solving singular integro-differential equations and their applications

M. V. Bulatov[1], D. T. Thanh[2]
[1]Instute for System Dynamics and Control Theory of Siberian Branch of Russian Academy of Sciences, Irkutsk State Technical University, Russian Federation
[2]Vietnamese Military Medical University, Ha Noi, Viet Nam
{mvbul@icc.ru, thanhdotien278}@gmail.com

Mathematical models of many physical processes include ordinary integro-differential equations (IDE), relative to the main part of the unresolved. For integral-differential equations, the main part refers to the leading derivative of the unknown vector function. The initial (and boundary) problem for such equations requires consider the question about the existence. Even if the solution of such problems exist and smooth, it usually can not be found analytically. If for such problems apply numerical methods developed for the ODE, resolved with respect to the main part, as a result, we obtain a system of equations, which either has no solution or has a lot of solutions. Even in the linear,case, discretization methods often produce unstable. General form of equation:

$$A(t)x'(t) + F(t, x(t)) + \int_0^t G(t, s, x(s))ds = f(t), \tag{1}$$

with given conditions. Cases are considered in detail:

1. $A(t) = t^p,\ p > 0,\ t \in (0, M],\ F(t, x) \equiv 0,\ x(M) = \xi$, where $x(t)$ – finding function;
2. $A(t)$ – $(n \times n)$-matrix, $F(t, x(t))$ and $G(t, s, x(s))$ – n-dimensions vector function, $t \in [0, 1]$, where $\det A(t) \equiv 0$, with given condition

$$x(0) = x_0, \tag{2}$$

The article has proposed and justified multi-step numerical methods for solving boundary value problems of nonlinear singular second-order differential equations and the IDE system with identically singular matrix at the main part.

2010 Mathematics Subject Classification: 70G60, 33E30.
Keywords: singular boundary value problem, integro-differential equation, multi-step methods.

CT-29. Model of vehicles queuing at the signalized intersection

Tomi Tristono*[1], M. Sidqon[2]
[1]Universitas Merdeka Madiun, [2]Universitas 17 Agustus 1945 Surabaya
{tomitristono, sidqonuntag}@gmail.com

The direct implications of the signalized causes a proportionally vehicles queuing on the one arm of the intersection while turning on the red signal. Otherwise, the number of vehicles queuing on the other arms decrease while switching on the green signal. This paper purposes the model of the number of vehicles queuing at the signalized intersection that has dynamical of periodic behavior in the term of stability around of the equilibrum point. The invariant model is a lemniscate curve with a varying degree of slope that located on positive quadrant only. The Jacobian method has presented the pure imaginary of the eigen-values, it implies that the model has orbitals. The stability test using Lyapunov fuction. The contur sketch of the model has a nice patttern based on their exact solutions.

2010 Mathematics Subject Classification: 37N35.
Keywords: model of vehicles queuing, signalized intersection, stability, equilibrum point.

CT-30. Dynamical modeling of dissolved oxygen level in water body with eutrophication

Endar H. Nugrahani*[1], Sri L. Mahmud[2], Paian Sianturi[1]
[1]Bogor Agricultural University, Indonesia, [2]Gorontalo State University, Indonesia
e_nugrahani@ipb.ac.id, srilestari.mahmud@ymail.com, psianturi15@gmail.com

Eutrophication is enrichment of nutrients through decomposition process that can lead to increased production of algae, which in turn reduces the dissolved oxygen level in the water body. Reduction of dissolved oxygen level is one environmental threat that should draw our attention, because it can lead to the death of fish and other aquatic living systems. This paper presents and analyzes a mathematical model of dissolved oxygen level in water bodies experiencing eutrophication, which is based on six variables under consideration, namely the concentration of nutrients, algae, macrophytes, and zooplankton population, as well as density of detritus and dissolved oxygen concentration. Some simulation results show that, if the rate of entry of nutrients into the water body increases, so increases the population of algae, macrophytes, zooplankton and detritus. However, this condition will bring the concentration of dissolved oxygen to decrease. In addition, the rate of conversion of detritus into nutrients also reduces the concentration of dissolved oxygen. Furthermore, if the rate of conversion of detritus into nutrients increases, then the concentration of dissolved oxygen in water bodies decreases.

2010 Mathematics Subject Classification: 37N25.
Keywords: dissolved oxygen, eutrophication, environment dynamical modeling.

CT-31. Dynamics of stage-structured prey-predator model with Crowley-Martin functional response

Sumit Kaur Bhatia, Sudipa Chauhan, Apurva Agarwal*
AIAS, Amity University, U.P, India
{sumit2212, sudipachauhan, apurva.sag17}@gmail.com

This paper is concerned with the study of the stage-structured prey-predator system with Crowley-Martin functional response. We have obtained boundary and interior equilibrium points of the system. We have also obtained the conditions ensuring the local stability of the equilibrium points. Permanence of the system has also been obtained. Numerical simulation are carried out based on important control parameters which are: handling time, capturing rate, interference among predators and death rate of mature prey.

2010 Mathematics Subject Classification: 34D, 92B, 15A18.
Keywords: prey-predator system, stability, Crowley-Martin, permanence.

CT-32. Analysis of a modified Leslie-Gower predator-prey model with Crowley-Martin functional response and prey refuge

Jai Prakash Tripathi
Department of Mathematics, Central University of Rajasthan, India
jtripathi85@gmail.com

In this paper, we study a two-dimensional continuous time dynamical system modelling a modified Leslie-Gower predator-prey system with Crowley-Martin functional response and prey refuge. The mutual interference by predator at high prey density differentiate between Crowley-Martin functional response and Beddington-DeAngelis functional response. We consider the permanence, non-permanence, local asymptotic stability behaviour of various equilibrium points and global asymptotic stability of positive equilibrium to understand the dynamics of the considered model system. Global asymptotic stability is discussed by applying fluctuation lemma. It is also observed prey refuge has a stabilizing effect into the considered system. The system undergoes into Hopf bifurcation with respect to parameters intrinsic growth rate of predators (s) and mutual interference (c). The stability of Hopf bifurcation is also discussed by calculating Lyapunov number. It is found that that a stable limit cycle bifurcates from the interior equilibrium solution. Finally, numerical simulations are presented to substantiate the analytical findings.

2010 Mathematics Subject Classification: 93C15, 37N25, 92B05.
Keywords: fluctuation lemma, parameter estimation, Crowley-Martin, global stability.

CT-33. On the dynamics of malaria-cholera co-infection under climate variability

Okosun K. O.[1], Abiodun G. J.[2]
[1]Vaal University of Technology, [2]University of the Western Cape, South Africa
{kazeemoare, abiodun234}@gmail.com

Malaria is a preventable and curable vector borne disease. The strategy for reducing malaria transmission is to protect individuals from mosquito bites by the distribution of inexpensive mosquito nets and insect repellents or by mosquito control measures such as indoor spraying of insecticides and draining of stagnant water where mosquitoes breed. The recent flooding across Africa and Asia continents posed a serious challenge to good environmental sanitation and availability of clean water and flooding provides a breeding condition for malaria and cholera to strive.
Method: In this paper, we develop a malaria - cholera climate model to study the effect of climate variability on malaria-cholera co-infection dynamics.
Results: Our results demostrate the effect of climatics factors on the co-infection dynamics of malaria-cholera.
Conclusion: It is found that malaria infection contributes to increase in the reproduction number of cholera in the presence of climate variability. That is, under climate change, cholera infection is associated with an increased risk for malaria and also, that malaria infection is not associated with an increased risk of cholera. Therefore, to effectively control malaria and cholera co-infection in the presence of climate variability, the malaria and cholera intervention strategies by policy makers must be carried out simultaneously.

2010 Mathematics Subject Classification: 92B05, 93A30, 93C15.
Keywords: malaria, cholera, climate, coinfection.

CT-34. Application of the homotopy method for solving interaction model of the immune system with HIV

Embay Rohaeti*, Ani Andriyati, Prasetyorini, Amar Sumarsa
Pakuan University
embayrohaeti@gmail.com

The interaction of the immune system with the human immunodeficiency virus (HIV) can be modeled into a nonlinear differential equations. These model includes the following cell: T-CD4, activated T-CD4, and CD8 T cytotoxic (CTL). We analyzing the population of the cells with respect to time. In solving the model, we use homotopy method which can solve any linear or nonlinear differential equations. We implement this method using Mathematica 7. The result will be an approximation function in a form of a series. By doing simulation for two cases, we conclude that if the initial immune system is good, the CTL will response faster to the HIV.

2010 Mathematics Subject Classification: 35C10.

Keywords: homotopy method, HIV, immune system.

CT-35. Dynamical system of tuberculosis spread model with two groups of infected population

Vina Apriliani*, Jaharuddin
Bogor Agricultural University, Indonesia
vina_april17@yahoo.com, jaharmath@gmail.com

In this paper, we study an SVEIR disease model of tuberculosis transmission dynamics in which the infected population is divided into two groups, namely infectious infected and noninfectious infected population. The equilibrium points and the basic reproduction number R_0 are determined. The stability analysis of the model was conducted by considering the basic reproduction number R_0. We show that if $R_0 < 1$, then the disease-free equilibrium is locally asymptotically stable. If $R_0 > 1$, then a unique endemic equilibrium is locally asymptotically stable. Some numerical simulations are also given to re-examine the stability of the equilibrium and to show the efficacy of vaccine. Numerical experiments suggest that a strategy of continuous vaccination would reduce the number of exposed and infected individuals.

2010 Mathematics Subject Classification: 92D30, 93A30, 93C10, 93D20.
Keywords: basic reproduction number, stability, SVEIR model, tuberculosis, vaccination.

CT-36. Stage-structured prey-predator model with maturation delay for prey and gestation delay for predator with holling type-ii functional response

Sudipa Chauhan[1], Joydip Dhar[2], Vandana Kumari*[1], Sumit Kaur Bhatia[1]
[1]AIAS, Amity University, U.P, India, [2]ABV-IIITM, Gwalior, M.P
sudipachauhan@gmail.com, jdhar@iiitm.ac.in, {apurva.sag17, sumit2212}@gmail.com

In this paper, we have studied stage-structure predator prey model with maturation delay in prey and gestation delay for predator. The resulting delayed model is analyzed for stability and bifurcation phenomena. Using comparison arguments, we established the sufficient conditions for the permanence of the system. We have obtained the existence of interior and boundary equilibrium points. Also, we have discussed the local stability of equilibrium points. Using an iterative technique, we obtained sufficient conditions for the global stability of all feasible equilibria of the system. Finally, we have verified the results using numerical simulations.

2010 Mathematics Subject Classification: 34D, 92B, 15A18.
Keywords: prey-predator, maturation delay, gestation delay, stability, bifurcation.

CT-37. Stability analysis and mathematical modeling of pomfret and tiger Grouper's growth on integrated multi-trophic aquaculture systems

Ririn Sulpiani*[1], Widowati[1], Sapto P. Putro[2]
[1]Department of Mathematics, Diponegoro University
[2]Department of Biology, Diponegoro University
ririnsulpiani@gmail.com, widowati_math@undip.ac.id

In this paper, we construct a mathematical modeling of growth pomfret, tiger grouper and nutrition. The model form of non-linear systems of differential equations. In the process of modeling the three variables were selected, namely, pomfret, tiger grouper and nutrition. Variables selected to cover mutualistic relation variables as floating net cage application of the Integrated Multi-Trophic Aquaculture (IMTA) systems. Analytical analysis were used to study the dynamic behavior of this model. Local stability analysis is performed at the equilibrium point with the first step linearized model by using Taylor series, then determined the Jacobian matrix. Furthermore be sought eigenvalues of the Jacobian matrix. If all the eigenvalues have negative real parts, then the equilibrium of system is locally asymptotically stable. However, if there exist the real part of the eigenvalues is positive then the equilibrium of system is unstable. Some numerical simulations are also demonstrated to verify our analytical results.

2010 Mathematics Subject Classification: 37N25, 97M60, 34D20.
Keywords: polyculture IMTA systems, mathematical modeling, dynamical systems, equilibrium point, stability.

CT-38. Dynamics of dengue transmission model in Baguio City, Philippines

Joel Addawe*[1], Donnabel Tubera[2], Aprimelle Kris Pajimola[1]
[1]University of the Philippines Baguio
[2]Donnabel Tubera, Health Services Office, Baguio City
jmaddawe@up.edu.ph, donnabel_md@yahoo.com, ajpajimola@up.edu.ph

In this paper, we develop a dynamical model characterising the spread of dengue fever in Baguio City, Philippines. The human population is divided into four compartments representing the Susceptible, Exposed, Infectious and Recovered hosts and the vector population is divided into the Susceptible, Exposed and Infectious compartments. In the proposed model, the flow between compartments is described by a set of differential equations. The qualitative properties of the proposed model are fully studied by computing the basic reproduction number, R_0, and the disease-free equilibrium. Stability analysis of the equilibrium point is carried out and using some parameter values, numerical simulation are shown for different scenarios.

2010 Mathematics Subject Classification: 34M03, 34D20, 37M05.
Keywords: dengue transmission, reproduction number, disease-free, endemic equilibrium.

CT-39. MERS epidemic model analysis with various interventions

H. Padma*, D. Aldila, H. Tasman, K. Khotimah
Departement of Mathematics, FMIPA, Univesitas Indonesia
{herningtyas.padma, aldiladipo, htasman}@sci.ui.ac.id, khusnul.khotimah21@ui.ac.id

Mathematical model for the spread of MERS with various interventions such as medical treatment, medical mask, and goverment campaign about the importance of medical mask are discussed in this article. The deterministic model is constructed using SIR model in five dimensional system which is interprate five different human population. Analytical and numerical analysis are used to explain existence of equilibrium points and basic reproduction number ($\mathcal{R}_0$) in this model. We find that disease free equilibrium point is locally asymtotic stable if $\mathcal{R}_0 < 1$ and unstable if $\mathcal{R}_0 > 1$. According to sensitivity analysis of $\mathcal{R}_0$, we find that the intervention of medical mask along with campaign about it is much better rather than medical treatment intervention to control the spread of MERS.

2010 Mathematics Subject Classification: 92D25, 93C95, 34B60.
Keywords: MERS disease, medical mask, equilibrium points, basic reproduction number, bifurcation.

CT-40. Towards improvising Malaysia palm oil production: dynamic hypothesis for dynamic simulation model development

M Faeid M. Zabid, Norhaslinda Zainal Abidin*, Shri-Dewi Applanaidu
Universiti Utara Malaysia
mohd_zabid@ahsgs.uum.edu.my, {nhaslinda, dewi}@uum.edu.my

Palm oil industry plays crucial role in Malaysia economy, accounting for more than five percent of its annual export. However, despite its excellent track record it actually has been way behind from its neighbour Indonesia in terms of palm oil production. The slow growth in palm oil production is a serious issues as this may jeopardize Malaysia market position in the long term future. Thus, this paper present a dynamic hypothesis of Malaysia palm oil industry focusing on palm oil production. Causal loop diagram was used to develop the mental model describing the main components and its inter-relationship in affecting palm oil production. The feedback processes within the model is the centre of discussion attempted to be highlighted in this paper. This conceptual framework was designed as a foundation for the dynamic simulation model development. This paper contributes by giving the insight of palm oil industry as a complex system towards searching the appropriate policy to improvise the palm oil production.

2010 Mathematics Subject Classification: 90B99.
Keywords: palm oil production, dynamic hypothesis, dynamic simulation model, causal loop diagram.

Poster Sessions

P-01. New delay-range-dependent exponential stability criteria of impulsive switched linear system with mixed interval non-differentiable time-varying delays and nonlinear perturbations

Kanit Mukdasai
Department of Mathematics Faculty of Science Khon Kaen University, Thailand
kanit@kku.ac.th

In this paper, we investigate the problem of exponential stability analysis for impulsive switched linear system with time-varying delays and nonlinear perturbations. The time delays are continuous functions belonging to the given interval delays, which mean that the lower and upper bounds for the time-varying delays are available, but the delay functions are not necessary to be differentiable. The uncertainties under consideration are nonlinear time-varying parameter uncertainties. Based on the combination of mixed model transformation, Halanay inequality, utilization of zero equations, decomposition technique of coefficient matrices and a common Lyapunov functional, new delay-range-dependent robust exponential stability criteria are established in terms of linear matrix inequalities (LMIs) for the system. A numerical example is presented to illustrate the effectiveness of the theoretical result.

2010 Mathematics Subject Classification: 37B25, 37C75.
Keywords: exponential stability, impulsive switched linear system, linear matrix inequality, Halanay inequality, model transformation.

P-02. Linearisation of a sequence of holomorphic contractions

Guitta Sabiini Rishmany
Notre Dame University Louaize-Lebanon
gsabiini@ndu.edu.lb

Consider a holomorphic map $F : \mathbb{C}^k \to \mathbb{C}^k$ fixing the origin, $F = L + \sum_{p\geq 2} H_p$, where $L := F'(0)$ is the linear part of F at the origin. By Poincare Theorem, if L is invertible and contractant and the spectrum of L doesn't satisfy any resonnance relation, then there exist a local biholomorphism ϕ such that $\phi(0) = 0, \phi'(0) = Id$ and $\phi^{-1} \circ F \circ \phi = L$. In this case, F can be reduced to a simple linear form and so this theorem is a fundamental tool in understanding the dynamics of F. My work consists to generalise the linearisation theorem to a sequence of holomorphic contractions $(F_j)_{j\geq 1}$ that can be composed: $F_n \circ F_{n-1} \circ \ldots \circ F_1$ exist for any n.

2010 Mathematics Subject Classification: 37F10, 37G05, 32H50.
Keywords: holomorphic contractions, linearisation, spectrum, resonnance.

P-03. Mathematical model of AKT phosporylation in presence of competitif inhibitor

Y. A. Adi*[1], F. Adi Kusumo[2], L. Aryati[2], M. S. Hardianti[3]
[1]Departement of Mathematics, Universitas Ahmad Dahlan
[2]Departement of Mathematics, Universitas Gadjah Mada
[3]Departement of Internal Medicine, Universitas Gadjah Mada
yudi.adi@math.uad.ac.id

AKT also known as protein kinase B, is a key components in a complex network of signaling protein that promotes cell growth, proliferation, and survival. Constitutive activation of AKT signaling pathway has been observed in Acute Myeloid Leukemia (AML), so that AKT became a potential target for theraphy of AML patients. In this paper, we discuss a Mathematical model of AKT phosphorylation in the presence of Perifosine as a small molecule inhibitor that compete with AKT. We present analitycal expressions for concentration of AKT,complex AKT-PIP3, complex PIP3-Inhibitor, and AKT phosphorylation in terms of dimensionless parameters using He's Homotopy Perturbation Method (HPM). The analytical results are compared with numerical simulation and satisfactory agreement is obtained.

2010 Mathematics Subject Classification: 14F35.
Keywords: mathematical modeling, AKT, homotopy perturbation method, simulation.

P-04. Nonlinear IS-LM business cycle model with time delays in capital accumulation

Endar H. Nugrahani*, Rosmely, Paian Sianturi
Bogor Agricultural University
e_nugrahani@ipb.ac.id, {rosmely50, psianturi15}@gmail.com

IS-LM business cycle model is a model of dynamical system in economics which considers gross product, capital stock, and interest rate as variables. In this paper we focus our attention to the nonlinear IS-LM business cycle model, in which the functions of investment, saving, and demand for money are nonlinear. The time delays occur in capital accumulation equation, which is newly defined with two time delays according to income and the capitalization itself. Applying stability switch criteria and bifurcation theory, we have proven that time delays cause the change in stability of equilibrium points and the occurrence of Hopf bifurcation. Some numerical simulations are presented to illustrate four different cases, according to the value of time delays in the system.

2010 Mathematics Subject Classification: 91G80.
Keywords: IS-LM model, time delays, Hopf bifurcation.

P-05. A cellular mathematical model of nasopharyngeal carcinoma with functional response and logistic function

Sugiyanto*[1], F. Adi Kusumo[1], L. Aryati[1], M. S. Hardianti[2]
[1]Mathematics Department, Universitas Gadjah Mada, Yogyakarta
[2]Faculty of Medicine, Universitas Gadjah Mada, Yogyakarta
sugimath@yahoo.co.id, f_adikusumo@gadjahmada.edu, lina@ugm.ac.id
diahbudiyanto@yahoo.com

This paper will discuss the mathematical model of the relationship between Ebstein Barr virus (EBV) and nasopharyngeal carcinoma. This research is six subpopulation of cells and one subpopulations of virus. There are three events in humans associated with nasopharyngeal carcinoma, i.e. (1) is not infected with EBV, (2) infected with EBV, but does not occur nasopharyngeal carcinoma, (3) occurs nasopharyngeal carcinoma. All three events will be simulated.

2010 Mathematics Subject Classification: 93A30.
Keywords: mathematical model, nasopharyngeal carcinoma, Ebstein Barr virus.

P-06. On the fast escaping set of transcendental semigroups

Bishnu Hari Subedi*, Ajaya Singh
Tribhuvan University, Kathmandu, Nepal
subedi_bh@cdmathtu.edu.np, singh.ajaya1@gmail.com

We discuss fast escaping set under transcendental semigroups with certain structure and properties. Several results of the dynamics associated with iteration of transcendental entire functions have been extended to the new settings of transcendental semigroups. We provide some basic results in the direction of Eremenko's conjecture. Finally we examine spider's web structure of fast escaping set under this new settings.

2010 Mathematics Subject Classification: 65Hxx.
Keywords: transcendental semigroups, fast escaping set, Eremenko's conjecture, spider's web.

P-07. Global stability of SACR epidemic model for hepatitis C on injection drug users

Dwi Lestari, Lidyana Candrawati
Math Education Dept, Yogyakarta State University, Indonesia
{dwilestari.math, lidyana.elcha}@gmail.com

This study aims to analyze SACR model of epidemics of hepatitis C on injecting drug users. This model is represented by a system of nonlinear differential equations. The analysis results obtained to equilibrium points that is disease free and endemic equilibrium point. The Disease-free equilibrium point is local asymptotically stable if the basic reproduction number is less than one, and it is global asymptotically stable if the basic reproduction number is less than or equal to one.

It means that for a long period of time, the infected population will decrease or even disappear so that the virus no longer exists in the population. Meanwhile, for the basic reproduction number is more than one, the disease-free equilibrium point is unstable and the endemic equilibrium point is local asymptotically stable. This shows that for a certain period, the Hepatitis C virus will be persist. Furthermore, based on the simulation of this model, found that the higher the average frequency of the use of needles together in injecting drug users, the more of the proportion of acute infection, chronic carriers and recovered, while the proportion of susceptible decreased.

2010 Mathematics Subject Classification: 37D35.
Keywords: hepatitis C, injecting drug users, the SACR model, equilibrium points, stability.

P-08. Effect of a small insoluble surfactant concentration on the shape of a steady sessile drop: numerical and asymptotic approaches

K. Yulianti*[1], A. Y. Gunawan[2], E. Soewono[2], L. Mucharam[3]
[1]Dept. of Math. Education, Universitas Pendidikan Indonesia
[2]Industrial and Financial Math. Research Group, Institut Teknologi Bandung
[3]Drilling Eng., Prod., Oil & Gas Man Research Group, Institut Teknologi Bandung
kartikay802@gmail.com, {esoewono,aygunawan}@math.itb.ac.id

We investigate the influence of a small surfactant concentration to the shape of a steady sessile drop, more specifically to the alteration of its contact angle. We construct a model for the distribution of the surfactant at the surface and an equation for the shape of drop. The equations are then solved numerically. To validate the numerical solutions, the asymptotic solution in the limit of zero bond number is presented. Results show that a small concentration of the surfactant on the drop surface causes the value of the drop's contact angle to be bigger than the free surfactant one. For this limiting case, the asymptotic results are compared to the numerical solution and both solutions are quite in agreement.

2010 Mathematics Subject Classification: 74F25, 74G10, 74G15.
Keywords: surfactant, drop shape, steady state, asymptotic approximation.

P-09. A dengue transmission model: dynamics and control

Jose Maria L. Escaner Iv*, Aurelio A. de los Reyes V
Institute of Mathematics, University of the Philippines Diliman
{joma, adlreyes}@math,upd.edu.ph

An SIR-SI framework is considered to model the dynamics of the dengue disease in human population. We assume that the system is not closed in the sense that the total host population is varying. Moreover, with the emergence of a vaccine for dengue, our model also includes a control parameter on the susceptible host. Our research focuses on the basic reproduction number on which disease-free

and endemic equilibria exist, corresponding stability conditions, as well as key parameters which are influential in our model. Simulations are obtained based on parameters estimated from Philippine data.

2010 Mathematics Subject Classification: 92D30, 34D20.
Keywords: dengue, reproduction number, equilibrium points, stability, control.

P-10. Simulation for the mathematical model of infection HPV on cervical cancer

Tri Sri Noor Asih*[1], Lina Aryati[2], Fajar Adi Kusumo[2], Mardiah S. Hardianti[3]
[1]Department of Mathematics, Semarang State University
[2]Department of Mathematics, Gadjah Mada University
[3]Medicine Faculty, Gadjah Mada University
trisrinoorasih@gmail.com

In the previous work, the infection of HPV on cervical cancer cells can be modeled as a following system of differential equations:

$$\frac{dS}{dt} = rS(1-(S+I)) - \alpha SV, \quad \frac{dI}{dt} = \alpha SV - aI - \delta I, \quad \frac{dV}{dt} = nI - cV,$$
$$\frac{dP}{dt} = \delta\, p\, I + b\, P - \theta \frac{P^2}{1+P^2}, \quad \frac{dC}{dt} = \theta\, \frac{P^2}{1+P^2} - kC.$$

To giving an illustration of the dynamics we did some simulation. It is not easy to get real data for this model because it needs cellular or molecular data from pathology experiment. In this paper we adopt some data from epidemiology data such as an infection rate, and some data from assumption such as intrinsic growth rate of susceptible cells. We also use some data from general biology such as the number of free virus in one infected cells. And then we compare the simulation result with the result from previous work.

2010 Mathematics Subject Classification: 62P10, 92C50, 37N25.
Keywords: cervical cancer, HPV, dynamics, simulation.

P-11. State characterization in model order reduction for estimation process

Didik Khusnul Arif, Dieky Adzkiya, Erna Apriliani
Department of Mathematics, Institut Teknologi Sepuluh Nopember
{didik, dieky, april}@matematika.its.ac.id

Model order reduction (MOR) is a widely used technique to reduce the computational complexity of mathematical models. We focus on the application of MOR to estimation of linear-time-invariant systems using Kalman filter. In our previous work, we have shown that by using MOR the accuracy of Kalman filter is almost the same than without using MOR. In that work, we leverage mean squared error to measure the accuracy of both methods. In this work, we propose an approach to determine the accuracy by using state characterization. More precisely, we want to

determine the relationship between states of the reduced model and states of the original model. In order to obtain the relationship, we follow construction of the reduced model. Finally, we illustrate the approach in a model of one-dimensional heat conduction.

2010 Mathematics Subject Classification: 93A30.
Keywords: state characterization, Kalman filter, model order reduction.

P-12. Dynamical analysis of a fractional order modified Leslie-gower predator-prey model with beddington-deangelis functional response

Agus Suryanto*, Isnani Darti, Syaiful Anam
Department of Mathematics, Brawijaya University
{suryanto, isnanidarti, syaiful}@ub.ac.id

A modified Leslie-Gower equation with Beddington-DeAngelis functional response is one of well known models to describe the predator and prey interaction. To capture the history of variables where the effect of recent memory is more important than the effect of older memory, we modify this model by including a fractional derivative instead of first order derivative. Hence we obtain a dynamical system of fractional order. The dynamics of the proposed model is then analyzed. Here we determine all possible equilibria including the existence condition of positive equilibrium points and their stability properties. Furthermore, the system of fractional differential equations will be solved numerically. In this case, the fractional derivative will be discretized using the Grünwald-Letnikov approximation in combination with a nonstandard finite difference method. Finally we show some numerical simulations to verify our analytical results. Our numerical results also show that the fractional order Leslie-Gower model with Beddington-DeAngelis functional response has richer dynamical behavior than the integer order.

2010 Mathematics Subject Classification: 34D20, 92D40.
Keywords: fractional predator-prey model, stability analysis, Grünwald-Letnikov approximation, nonstandard finite difference method.

P-13. Solutions of fractional differential equations in form Mittag-Lefler function and its application in viscoelasticity

Endang Rusyaman*, Kankan Parmikanti
Department of Mathematics, Universitas Padjadjaran
{rusyaman, parmikanti}@unpad.ac.id

Ordinary differential equations is a branch of mathematics that is very interesting to always be learned and developed, it is because a lot of variations of the equation both in theory and its application. In general, the much-discussed differential equation is ordinary differential equation that have natural number orders, whereas the order of a differential equation has been developed into a fractional-order ie rational numbers is also very interesting to study. This paper will present

a study of ordinary differential equations that have fractional order, in which the left side contains two derivative functions with fractional order, while the right side contains polynomial function n degree. More specifically, this paper will be present about the general form of equations, methods of finding solution in three cases, and how its application. Solutions will be sought using the Laplace transformation and its inverse, and will be expressed in the form of Mittag-Lefler function was later described graphed using Matlab. Results of this reseach are three functions and graphs as solutions of the three forms of ordinary differential equations that have fractional order. Additionally, it will be shown also that the convergence of a sequence of numbers as order of fractional differential equation is directly proportional to convergence of solution function sequence. Many applications of fractional differential equations in field viscoelasticity, therefore at the end of the paper, will be presented of this application, particularly about the relationship between stress and strain for solids and for Newtonian fluids.

2010 Mathematics Subject Classification: 34A08, 26A33, 76A10.
Keywords: ordinary differential equations, fractional order, Mittag-Leffler, viscoelasticity.

P-14. Fractal analysis of retinal image using box-counting fractal dimension to recognition of diabetic retinopathy

Diah Safitri, Dwi Juniati
Department of Mathematics, Universitas Negeri Surabaya
{diah ws2603, dwi juniati}@yahoo.com

Diabetes mellitus (DM) is a disorder of metabolism that occur when pancreas does not product hormone insulin or body can not use hormone insulin effectively. Hormone insulin is hormone that organize blood glucose. According to the International Diabetes Federation (IDF), in 2013 there were 382 million people worldwide are affected by diabetes. It is estimated that in 2030 people with diabetes will increase to 592 million people. World Health Organization (WHO) reported that Indonesia is a fourth grade country with the highest number of patients with DM. DM is known as silent killer disease because of their complications. Diabetic retinopathy is a complication of diabetes that lead a rates of blindness in adults. Based on The DiabCAre Asia in 2008, 42The structure of the blood vessels in the retina can be considered as fractal with self-similarity, so fractal dimension calculation is applied to classify the structural of the retinal blood vessels. In this research, Box-counting dimension method is used to determine fractal dimension of retinal blood vessel and this result can be used to make a classification of retina condition and to indicate a difference stage of the diabetic retinopathy, that are health retina, diabetic retinophaty, light non-poliferatif retinophaty , moderate nonpoliferatif retinophaty , serious non-poliferatif retinophaty and poliferatif. The steps of this classifications is, at first retinal image is changed to grayscale and use Contrast Limited Adaptive Histogram Equalization to have a clearer image. After that, filtering, masking, edge detecting, thresholding and denoised. Fractal

dimension Calculation is applied to these extraction image, and use the minimal distance to classify the retina conditions.

2010 Mathematics Subject Classification: 68U05, 65D18.
Keywords: diabetic retinopathy, fractal analysis, fractal dimension of blood vessel.

P-15. Discretization of mathematical model of immune system and mycobacterium tuberculosis interaction

Usman Pagalay, Wahyuni Fitria Aprilia Wati, Wahyu H. Irawan
Dept. of Math., Maulana Malik Ibrahim State Islamic University of Malang
Usmanpagalay@yahoo.co.id, Wahyuniaprilia93@gmail.com, henky_lily@yahoo.com

Mathematical model of the immune system interaction and mycobacterium tuberculosis consist of six variables namely activated macrophages, infected macrophages, T cells CD4+, T cells CD8+, extracellular bacteria, and intracellular bacteria. Those model forms a system of first order nonlinear differential equations. In this research, the discretization of mathematical model has been performed using finite different method, and its discrete and continuous graphs had been compared. The result of this research shows that mathematical model discretization for macrophages and T cells have a relatively small error compared to mathematical model discretization of bacteria that have a considerable error. Comparison of continuous and discrete graphs of macrophages and T cells are relatively same, while for the bacteria it is still very different in a simulation from $t = 0$ to $t = 2000$.

2010 Mathematics Subject Classification: 70J50.
Keywords: discretization, immune system, mycobacterium tuberculosis.

P-16. Optimal control of host-vector model using pontryagin minimum principle

Eminugroho Ratna
Yogyakarta State University, Indonesia
eminugrohosari@gmail.com

A host-vector model for dengue disease is presented to explain the interaction between human and mosquito. analytically, epidemic behavior appears. hence, it is reasonable to fight the disease with control strategy. there are three kinds of control which included in the new model: preventive control is given to susceptible host, insecticide control is given to vector population, and treatment control is given to infected host. using pontryagin minimum principle, an optimal control approach with minimum cost is obtained in order to find the best way to decrease the disease.

2010 Mathematics Subject Classification: 46C20.
Keywords: host-vector model, control, pontryagin minimum principle.

P-17. Asymptotic properties of the sample codifference function of ma(q) process with infinite variance

Iqbal Kharisudin[1], Dedi Rosadi[1], Abdurakhman[1], Suhartono[2]
[1]Department of Mathematics, Gadjah Mada University
[2]Department of Statistics, Institut Teknologi Sepuluh Nopember
iqbalkharisudin@mail.unnes.ac.id, {dedirosadi, achmanstat}@ugm.ac.id
suhartono@statistika.its.ac.id

In this paper, we derive the closed form formula for the asymptotic variance of the sample codiference function of moving average processes of order q with SaS innovation. This result is the direct extension of the results discussed in [11] for iid process and [4] for MA(1) process. An example of the practical use of the results presented in this paper for identification of moving average process is given in the forthcoming paper [5], as the extension of results presented in [12].

2010 Mathematics Subject Classification: 37M10.
Keywords: dependence measure, codifference, infinite variance, symmetric α-stable.

P-18. Some elements of the behavior around the infinite poles

Gantina Rachmaputri
Institut Teknologi Bandung
gantina.r@math.itb.ac.id

In this paper, we shall study some elements of the behavior of a dynamical system around the infinite poles. This study deduced by identifying the generalized state space of the system as a natural polynomial module structure over the formal series ring. This is the key result that allows to reformulate the system and study its behavior in rational terms.

2010 Mathematics Subject Classification: 93B25.
Keywords: behavior, infinite pole, predictor system, rational model.

S06. Partial Differential Equations

Invited Talks

IT-01. Tornado on Potter's invisibility cloak: nonlinear waves in metamaterials

Hadi Susanto
Department of Mathematical Sciences, University of Essex
hsusanto@essex.ac.uk

Invisibility has long been employed in works of fantasy, including Harry Potters magic cloak. Scientists are actually making devices with these properties by developing what are known as metamaterials (engineered materials with properties that do not occur naturally), which can bend electromagnetic radiation, such as light, around an object, giving the appearance that it is not there at all. In this talk, we will review our recent analytical and numerical results on the existence and uniqueness of periodic and localised travelling waves in metamaterials that are modelled by, among others, differential-difference equations.

2010 Mathematics Subject Classification: 35C07, 76B25, 34K08.
Keywords: nonlinear waves, periodic and localised waves, metamaterials, differential-difference equations, advance-delay equations.

IT-02. Two-phase flows with phase transitions

Senjo Shimizu
Kyoto University, Japan
shimizu.senjo.5s@kyoto-u.ac.jp

We consider models for two-phase flows with phase transitions. These are based on first principles, i.e., balance of mass, momentum, and energy. For incompressible two-phase flows, we prove local well-posedness of the model in an L_p-setting which is based on maximal regularity. We also study the stability of the equilibria of the problem. For compressible two-phase flows, we analyze a simplified model, where the temperature is assumed to be constant. An interface between compressible fluids is fragile in contrast to incompressible fluids, we obtain local existence of the problem. This is a joint work with Jan Prüss (Halle, Germany).

2010 Mathematics Subject Classification: 35Q35, 35Q30, 76T10, 76D45, 76N10.
Keywords: Navier-Stokes equations, free boundary problems, phase transitions, wellposedness, stability.

IT-03. Multiscale methods and analysis for the nonlinear Klein-Gordon equation in the nonrelativistic limit regime

Weizhu Bao
Department of Mathematics, National University of Singapore
matbaowz@nus.edu.sg

In this talk, I will review our recent works on numerical methods and analysis for solving the nonlinear Klein-Gordon (KG) equation in the nonrelativistic limit regime, involving a small dimensionless parameter which is inversely proportional to the speed of light. In this regime, the solution is highly oscillating in time and the energy becomes unbounded, which bring significant difficulty in analysis and heavy burden in numerical computation. We begin with four frequently used finite difference time domain (FDTD) methods and obtain their rigorous error estimates in the nonrelativistic limit regime by paying particularly attention to how error bounds depend explicitly on mesh size and time step as well as the small parameter. Then we consider a numerical method by using spectral method for spatial derivatives combined with an exponential wave integrator (EWI) in the Gautschi-type for temporal derivatives to discretize the KG equation. Rigorious error estimates show that the EWI spectral method show much better temporal resolution than the FDTD methods for the KG equation in the nonrelativistic limit regime. In order to design a multiscale method for the KG equation, we establish error estimates of FDTD and EWI spectral methods for the nonlinear Schrodinger equation perturbed with a wave operator. Based on a large-small amplitude wave decompostion to the solution of the KG equation, a multiscale method is presented for discretizing the nonlinear KG equation in the nonrelativistic limit. Rigorous error estimates show that this multiscale method converges uniformly in spatial/temporal discretization with respect to the small parameter for the nonlinear KG equation in the nonrelativistic limite regime. Finally, applications to several high oscillatory dispersive partial differential equations will be discussed.

2010 Mathematics Subject Classification: 65M12, 65M15, 65M70, 81Q05.
Keywords: Klein-Gordon equation, nonrelativistic limit, multiscale decomposition, uniformly accurate, exponential wave integrator.

IT-04. Nonlinear elliptic systems with mixed attractive and repulsive interactions

Jaeyoung Byeon
Department of Mathematical Sciences, KAIST, Republic of Korea
byeon@kaist.ac.kr

I will introduce the asymptotic behavior of positive least energy vector solutions to nonlinear Schrödinger systems with mixed couplings which arise from models in Bose Einstein condensates and nonlinear optics. Due to mixed attractive and repulsive interactions the least energy solutions exhibit new interesting

component-wise pattern formations, including co-existence of partial synchronization and segregation.

2010 Mathematics Subject Classification: 35J20, 35J500
Keywords: mixed interactions, nonlinear Schrödinger systems, multiple scaling, partial synchronization and segregation

Contributed Talks

CT-01. Fluid-structured coupled wave scattering of waveguides with abrupt changes in height

Rab Nawaz
COMSATS Institute of Information Technology Park Road Islamabad, Pakistan
rabnawaz@comsats.edu.pk

This paper addresses a class of boundary value problems arising in the modelling of fluid-structure coupled waves scattering in ducts or channels with abrupt geometric changes and discontinuous material properties. The main purpose is to invoke the semi-analytic methods such as mode-matching and Galerkin techniques to render the solutions to these boundary value problems. The envisaged scattering problems are governed by Laplace or Helmholtz equations together with high-order boundary conditions describing flexible ducts or channel boundaries. It is substantiated that the separation of variables reduces these boundary value problems to non-Strum-Liouville eigen-systems wherein the eigenfunctions are neither orthogonal nor linearly independent. In the process generalized orthogonal relations would be established which, together with a mode-matching technique, render a solution by matching modes across the interfaces of the geometric and material discontinuities. The emphasis would be on flexible bounded ducts involving rigid/flexible step discontinuities at interfaces. Such types of investigations are considered to be the useful techniques for solving many structural problems in waveguide theory. Through the confirmation of physical laws we ensure both the physical and mathematical validation of the underlying problems.

2010 Mathematics Subject Classification: 35Kxx, 35Qxx, 65Nxx.
Keywords: acoustic, scattering, mode-matching, waveguide.

CT-02. A semigroup theoretic approach to a semilinear diffusive equation with time delay and impulses

Cece Kustiawan*, Jalina Widjaja, Yudi Soeharyadi
Institut Teknologi Bandung, Indonesia
cecekustiawan@students.itb.ac.id, {jalina, yudish}@math.itb.ac.id

We discuss well-posedness of a semilinear diffusive equation with time delay and impulses using semigroup approach. First, the equation will be consider in

every time interval, bounded by two consecutive impulse times. Using the suitable semigroup for delay equation, the existence of solution is obtained. In the case of diffusive logistic equation, an attractor of the system is obtained by assigning some conditions on the size of impulses and impulse times. Some numerical simulation is included.

2010 Mathematics Subject Classification: 35A01, 47H20, 34A37.
Keywords: semigroup, well-posedness, DDE, impulses.

CT-03. Amplitude dynamics of soliton sequences of perturbed coupled nonlinear Schrödinger equations

Quan M. Nguyen*[1], Avner Peleg[2], Toan T. Huynh[3]
[1]Vietnam National University-HCMC, Vietnam
[2]Afeka College of Engineering, Tel Aviv, Israel
[3]University of Medicine and Pharmacy-HCMC, Vietnam
quannm@hcmiu.edu.vn

We develop a propagation model consisting of a system of N perturbed coupled nonlinear Schrödinger (NLS) equations. We show that dynamics of soliton amplitudes in N-sequence transmission is described by N-dimensional Lotka-Volterra (LV) models. We study the stability and bifurcation analysis of the equilibrium points to stabilize soliton-sequence propagation and to achieve on-off and off-on transmission switching of M out of N soliton sequences. The results of numerical simulations with a system of N coupled nonlinear Schrödinger equations ($2 \leq N \leq 4$) show excellent agreement with the LV model's predictions and stable propagation over significantly larger distances compared with other broadband nonlinear waveguides. We then discuss the reasons for the robustness of transmission stabilization and switching in waveguides with broadband delayed Raman response and narrowband Ginzburg-Landau gain-loss profile.

2010 Mathematics Subject Classification: 35Q55, 35Q56, 35Q60.
Keywords: NLS equation, optical solitons, Lotka-Volterra model, multichannel optical waveguide transmission

CT-04. Boussinesq equations as a model of wave generation

L. H. Wiryanto*[1], Sudi Mungkasi[2]
[1]Faculty of Mathematics and Natural Sciences ITB
[2]Department of Mathematics, University Sanata Dharma, Yogyakarta
leo@math.itb.ac.id

When a uniform stream on an open channel is disturbed by existing of a bump at the bottom of the channel, the surface boundary forms waves growing and propagating. The model of the wave generation can be a forced Korteweg de Vries (fKdV) equation or Boussinesq-type equations. In case the governing equations are approximated from steady problem, the fKdV equation is obtained. The

model gives two solutions representing solitary-like wave, with different amplitude. However, phyically there is only one profile generated from that process. Which solution is occured, we confirm from unsteady model. The Boussinesq equations are proposed to determine the stabil solution of the fKdV equation. From the linear and steady model, its solution is developed to determine the solution of the unsteady one, so that it can explain the physical phenomena, i.e. the process of the wave generation, wave splitting and wave propagation.

2010 Mathematics Subject Classification: 76B07, 65M25.
Keywords: Boussinesq equations, fKdV equation, solitary-like wave

CT-05. Image enlargement using partial differential equation with positivity preserving cubic said-ball curves boundary condition

Azizan Saaban[1], Ahmad Saleh Abdulah Kherd[2]
[1]Universiti Utara Malaysia, [2]Yemen Al-Ahgaff University
azizan.s@uum.edu.my, as_kherd@hotmail.com

This paper will discuss the use of polynomial solution of fourth order linear PDEs with positivity preserving cubic Said-Ball curves boundary condition in image enlargement area. Resizing an image through up sampling or down sampling is generally common for making smaller image fit a bigger screen in full screen mode or reducing a higher resolution image to a smaller resolution. However due to some limitation, this paper will focus on image enlargement based on scaling factor of two. The coefficients of polynomial form can be calculated from the edge Said-Ball ordinates of rectangular patch which fulfill the positivity preserving conditions. We implement and evaluate the performance of the proposed method using well-known gray-scale test images.

2010 Mathematics Subject Classification: 35Q35.
Keywords: partial differential equation, Said-Ball, positivity preserving

CT-06. Deformation of bichromatic wave groups based on third order side band solution of Benjamin bona mahony equation

Marwan Ramli*[1,2], Vera Halfiani[2]
[1]Department of Mathematics, Syiah Kuala University Banda Aceh
[2]Dynamic Applications and Optimizations Group, Syiah Kuala University
marwan.math@unsyiah.ac.id ,verahalfiani@yahoo.com

This paper concerns on propagation of Benjamin Bona Mahony wave group in hydrodynamic laboratory. It is motivated by the needs of hydrodynamic laboratory to generate extreme waves deterministically in a wave tank. Such waves will be used to test a floating body object before operated. The previous results : experimental, analytical and numerical show that nonlinear effects will deform the wave and may lead to large waves with wave heights larger than twice the original input; the deformations may show itself as peaking and splitting. To investigate this,

especially at which location in the wave tank, the extreme position, the waves will achieve their maximum amplitude and to know the amplitude amplification factor, a concept called Maximal Temporal Amplitude (MTA) is used. This quantity is a tool that can be used to measure the maximum amplitude of wave over time. In this paper we will use Benjamin Bona Mahony (BBM) model and third order side band approximation theory to investigate the peaking and splitting phenomena of wave group which initially in bichomatic signal in the wave maker. The bichromatic signal here is a signal which is described by superposition of two monochromatic signals with the same in amplitude but slightly different in frequencies. We show that the wave deform in their propagation in the wave tank. The theoretical results are verified with numerical as well as experimental results.

2010 Mathematics Subject Classification: 35Q35, 35Q53, 76B15.
Keywords: bichromatic wave, Benjamin-Bona-Mahony, maximal temporal amplitude, wave deformation.

CT-07. Biharmonic on annulus with polynomial data

Ikhsan Maulidi*[1], Agah D. Garnadi[2]
[1]Sumatera Technology Institute, [2]Bogor Agricultural University, Indonesia
ikhsanmaulidi@rocketmail.com, agah.garnadi@gmail.com

We studied Biharmonic boundary value problem on annulus with polynomial data. We utilize an exact algorithms for solving Laplace equations with Dirichlet conditions with polynomial functions data. The algorithm requires differentiation of the boundary function, but no integration.

2010 Mathematics Subject Classification: 31A30, 44A10.
Keywords: biharmonic, Laplace equation, polynomial data, Dirichlet condition.

CT-08. Analytical and numerical solutions of some non-linear PDEs by HAM

Rajan Arora*, Ankita Sharma
Indian Institute of Technology Roorkee, India
rajanfpt@iitr.ac.in, ank02dpt@iitr.ac.in

In this paper, we first describe the methodology of the Homotopy Analysis Method (HAM) which is an analytical technique and then employ it to some of the non-linear problems which are used in different fields of sciences like plasma physics, fluid dynamics, laser optics, biology, chemical kinetics, nucleation kinetics, physiology, etc. Approximate series solutions have been obtained and the results are compared with the closed form solutions of the equations which show that this technique gives high accurate results. HAM is a reliable technique, easy to use and is widely applicable to a large class of non-linear differential equations.

2010 Mathematics Subject Classification: 35Q70, 35Q90.
Keywords: homotopy analysis method, 7th-order Caudrey-Dodd-Gibbon equation, Fisher-type equation.

CT-09. Propagation of blast wave problem in a non-ideal gas

Rajan Arora*[1], Sanjay Yadav[2]
[1]Department of Applied Science and Engineering, IIT Roorkee India
[2]Department of Applied Science, The Northcap University Gurgaon Haryana India
rajan_a100yahoo.com

The paper contains an analytical approach to construct the solution of the blast wave problem in a non-ideal medium. It is assumed that the density ahead of the shock front varies according to a power of distance from the source of the blast wave. Also, the solution for an ideal gas which was obtained by Sakurai is a particular case, and a compression is shown.

2010 Mathematics Subject Classification: 58J45, 65M06.
Keywords: blast wave, analytical solution, non-ideal gas.

CT-10. Certain nonlinear singular partial differential equations in the ultra-differentiable class

Randy L. Caga-Anan*[1], Jose Ernie C. Lope[2]
[1]Mindanao State University-IIT, Philippines
[2]University of the Philippines-Diliman
randy.caga-anan@g.msuiit.edu.ph, ernie@math.upd.edu.ph

In their 2012 paper, Lope, Roque, and Tahara considered nonlinear singular partial differential equations of the form

$$t\frac{\partial u}{\partial t} = F\left(t, x, u, \frac{\partial u}{\partial x}\right), \tag{1}$$

where the function F is defined on $\Omega = [0,T] \times D_R \times B_\rho \times D_\rho$ (with $T, R, \rho > 0$), where $B_r = \{x \in \mathbb{C} : |x| \leq r\}$ and $D_r = \{x \in \mathbb{C}^n : |x| \leq r\}$, and F is assumed to be continuous in t and holomorphic in the other variables. Using weight functions to describe certain growth assumptions on the coefficients of the partial Taylor expansion of F, they established a unique solution to ((1)) having a certain growth estimate, in the space of holomorphic functions. Now, let X be a Banach space, U an open subset of X, and Y a complex Banach space. A map $v \in C^\infty(U,Y)$ is said to belong to the *ultradifferentiable class* $\{M_p\}(U,Y)$ or $\{M_p\}$ for short, if for some constant C, $\|D_x^j v(x)\| \leq C^{1+j} M_j, \quad x \in U, \quad j = 0,1,2,\ldots$, where D_x denotes Fréchet differentiation with respect to x. This class is smaller than the class of infinitely differentiable maps but strictly larger than the class of analytic maps-the holomorphic functions in $\mathbb{C}$. Here, we establish an existence and uniqueness theorem on equations similar to ((1)), in the ultradifferentiable class. To do so, we use the Banach fixed point theorem and the iterative method of Nishida and Nirenberg.

2010 Mathematics Subject Classification: 35A01, 35A02, 35F20.
Keywords: ultradifferentiable, Banach fixed point, Nishida-Nirenberg.

CT-11. On the numerical solution of Fisher equation by iterative splitting method

Hamzah, D. A., Tuwankotta, J. M., Soeharyadi, Y.
Intstitut Teknologi Bandung
dadang_amir_math@students.itb.ac.id, {theo, yudish}@math.itb.ac.id

In this paper, we use the method of iterative splitting method on the Fishers Equation and compered with sequential splitting method. These method are based on splitting the complex problem into simpler sub-problems while the difference are the iteration used at one step time. In the operator splitting method each sub-equation is combined with iterative schemes and solved with suitable integrators a, while in sequential splitting method at one step time the problem splitted and solved saperately. To achieve stability criteria for the proposed method applied to the Fishers equation we perform Von Neumann analysis. The numerical results obtained by iterative splitting method and the sequential splitting method are compered with the exact solutions and for comparation we also use the Crank-Nicholson scheme. It is seen that the iterative splitting method have the smallest error compered to the other.

2010 Mathematics Subject Classification: 65M12, 65M99, 65M06.
Keywords: fisher equation, iterative splitting methods, strang splitting method.

CT-12. Nonlinear biharmonic problem with fully nonlinear term

Q-Heung Choi*[1], Tacksun Jung[2]
[1]Department of Mathematics Education, Inha University, Korea
[2]Department of Mathematics, Kunsan National University, Korea
qheung@inha.ac.kr, tsjung@kunsan.ac.kr

We get one theorem that there exist solutions for the fourth order nonlinear elliptic with Dirichlet boundary value problem with fully nonlinear term. We prove this result by the critical point theory; the variation of linking method and category theory.

Let Ω be a bounded domain in R^n with smooth boundary $\partial\Omega$ and let $b \in R$ be a constant. Let $\lambda_k (k = 1, 2, \cdots)$ denote the eigenvalues and $\phi_k (k = 1, 2, \cdots)$ the corresponding eigenfunctions, suitably normalized with respect to $L^2(\Omega)$ inner product, of the eigenvalue problem $\Delta u + \lambda u = 0$ in Ω with $u = 0$ on $\partial\Omega$,where each eigenvalue λ_k is repeated as often as its multiplicity. We recall that $\lambda_1 < \lambda_2 \leq \lambda_3 \ldots \to +\infty$, and that $\phi_1(x) > 0$ for $x \in \Omega$.

We investigate the existence of the nontrivial solutions for the following fourth order semilinear elliptic equation with fully nonlinear term

$$\Delta^2 u + c\Delta u + bu^+ = (u^+)^{p-1} - (u^-)^{q-1} \qquad \text{in } \Omega,$$

$$u = 0, \qquad \Delta u = 0 \qquad \text{on } \partial\Omega,$$

where $c \in R$, $u^+ = \max\{u, 0\}$ and $2 < p, q < \frac{2n}{n-2}$ $(p \neq q)$.

2010 Mathematics Subject Classification: 35J35, 35J58.
Keywords: fourth order elliptic boundary value problem, fully nonlinear term, critical point theory, variation of linking method.

CT-13. Multiple solutions for the Hamiltonian system with singular nonlinear term

Tacksun Jung*[1], Q-Heung Choi[2]
[1]Department of Mathematics, Kunsan National University, Korea
[2]Department of Mathematics Education, Inha University, Korea
tsjung@kunsan.ac.kr, qheung@inha.ac.kr

We investigate multiple periodic solutions for the Hamiltonian system with singular potential. We get a theorem which shows existence of weak solutions for the Hamiltonian system with some singular nonlinear term. We obtain this result by using variational method and critical point theory for indefinite functional. Let Ω be an open subset in R^{2n} with compact complement $D = R^{2n}\backslash\Omega$, $n \geq 2$. Let $x(s) \in C^2([0, 2\pi], \Omega)$ and $G(s, (p(s), q(s))) \in C^2([0, 2\pi] \times \Omega, R^1)$. In this paper we investigate the number of the solutions $x(s) \in C^2([0, 2\pi], \Omega)$ with singular nonlinearity and periodic condition $-J\dot{x} = G_x(s, x(s))$, $x(0) = x(2\pi)$ where

$$J = \begin{pmatrix} 0 & -I_n \\ I_n & 0 \end{pmatrix},$$

where I_n is a $n \times n$ identity matrix and $\dot{x} = \frac{dx}{ds}$. We assume that $G(s, x(s)) \in C^2([0, 2\pi] \times \Omega, R^1)$ satisfies the following conditions:
$(G1)$ There exists $R_0 > 0$ such that

$$\sup\{|G(s, x(s))| + \|\mathrm{grad}_x G(s, x(s))\|_{R^{2n}} \mid (s, x) \in [0, 2\pi] \times (R^{2n}\backslash B_{R_0})\} < +\infty.$$

$(G2)$ There is a neighborhood X of D in R^{2n} such that

$$G(s, x) \geq \frac{a}{d^2(x, D)} \quad \text{for} \quad (s, x) \in [0, 2\pi] \times X,$$

where $d(x, D)$ is the distance function to D and $a > 0$ is a constant.

2010 Mathematics Subject Classification: 35Q72.
Keywords: Hamiltonian system, variational method, critical point theory for indefinite functional.

CT-14. Heat transfer in MHD flow of carbon nanotubes suspended nanofluid over a stretching sheet

Abid Hussanan*[1], Mohd Zuki Salleh[1], Ilyas Khan[2]
[1]Faculty of Industrial Science and Technology Universiti Malaysia Pahang, Malaysia
[2]College of Engineering, Majmaah University, Saudi Arabia
{abidhussnain_utm, zukikuj, ilyaskhanqau}@yahoo.com

This article mainly focuses on the heat and mass transfer with the effects of carbon nanotubes (CNTs) of magnetohydrodynamic (MHD) nanofluid flow over a stretching sheet in the presence of thermal radiation and convective boundary condition. Two types of CNTs, namely, single and multi-wall CNTs are used with water as convectional base fluid. With the help of similarity transformations, the governing equations are converted into nonlinear ordinary differential equations. Closed form analytic solutions for velocity, temperature and concentration are obtained. These solutions are plotted graphically and discussed for different parameters. Nanotube suspensions, containing a small amount of CNTs, have substantially higher thermal conductivities than the base fluids, with the enhancement increasing with the volume fraction of CNTs. Some existing solutions of the particular cases of the same problem are also verified as the special cases of the present solutions.

2010 Mathematics Subject Classification: 76Dxx, 76Rxx, 76Wxx.
Keywords: MHD, carbon nanotubes, stretching sheet, thermal radiation.

CT-15. On Lax-Oleinik type formula for multi-time conservation laws

Nguyen Huu Tho
Department of Mathematics, Thuy Loi University Hanoi, Vietnam
nhtho@tlu.edu.vn

This note concerns the findings of weak solutions of the Cauchy problem for Multi-Time Conservation laws. Relying on the result on Multi-Time Hamilton-Jacobi equations, we introduce the Lax-Oleinik Type formula for weak solution to Multi-Time Conservation laws.

2010 Mathematics Subject Classification: 35F21, 35F45, 39Q91, 35D30.
Keywords: conservation laws, weak solution, Hamilton-Jacobi equations, multi-time partial differential equations, Lax-Oleinik formula.

Poster Session

P-01. Parametrized perturbation results on global positive solutions for elliptic equations involving critical sobolev-hardy exponents and hardy terems

Wan Se Kim
Dept. of Math., Research Inst. for Natural Sciences, Hanyang University, Korea
wanskim@hanyang.ac.kr

We establish extence and bifurcation of global positive solutions for parametrized nonhomogeneous elliptic equations involving critical Sobolev-Hardy exponents and Hardy terms. The main approach to the problem is the variational method

2010 Mathematics Subject Classification: 35F21, 35F45, 39Q91, 35D30.
Keywords: conservation Laws, weak solution, Hamilton-Jacobi equations, multi-time partial differential equations, Lax-Oleinik formula.

P-02. Pricing American down-and-out call option using Fourier transform

Dewi Mashitasari*, Endah Rokhmati M. Putri
Mathematics Department, Sepuluh Nopember Institute of Technology
desikurniawati85@yahoo.com, endahrmp@gmail.com

One of method to get closed-form solution from American option is using Fourier transform. Based on current existing research, there are three methods using Fourier transform, are McKean method, Kim method, and Carr, Jarrow, and Myneni method, which has closed-form solution in integral form. This research will extend the use of Fourier transform to find the closed-form solution of American Down-and-Out Call Option based on McKean method.

2010 Mathematics Subject Classification: 60H15,35R60,35S30.
Keywords: American call option, barrier down-and-out option, Fourier transform.

P-03. Comparison of binomial method and laplace on American put option as an investment of a life insurance participating policies endowment type

Hermei Lissa*, Endah R.M. Putri
Sepuluh Nopember Institute of Technology Surabaya
{meycados, endahrmp}@gmail.com

Insurance is a form of protection by transferring the possible risks of an uncertain event. One type of insurance is life insurance. Most people awareness of the need to have insurance as a form of life protection is still very small. This is due to a lack of understanding about insurance. With the changing times, life insurance launches innovative products, one of them is a life insurance participating policies.

Life insurance participating policies is a term insurance and also an investment. This paper discusses a problem about pricing the American put option as an investment life insurance participating policies and pricing policy of life insurance participating policies with investment in the American put option, analyze the value of the American put option that uses a Binomial method and Laplace. Numerical solution can obtain using the binomial method and for analytical solutions obtained using laplace method. Thus price policy life insurance with participating policies can determined.

2010 Mathematics Subject Classification: 91-xx, 91Gxx, 91G80.
Keywords: life insurance , participating policies, American put option, Laplace transforms, binomial method.

P-04. The distinction of asymptotic behaviour optimal stock prece American call option and stock loan

Noviana Tri Utami*, Endah R. M. Putri
Sepuluh Nopember Institute of Technology Surabaya
echanovia8@gmail.com, endahrmp@gmail.com

Stock loan is a contract between two parties, they are the borrower and the lender with stock as the collateral. American call option is a contract that gives right to the holder to buy or sell the stock any time, before or at maturity date. Similarities mechanism of stock loan contract with American call option causes the free boundary problems in the stock loan which the analytic solutions are very difficult or even can not be obtained. But there is difference between them, that is the possibility of a negative value of the accumulated interest rate on the stock loan.Therefore, in this paper is examined the differences between the American call option and stock loan based on asymptotic behavior at infinite maturity date. In addition Crank-Nicolson method used to find numerical solutions. Then it will be simulated using the matlab program. From the simulation results it is expected to know the difference value of the American call option and stock loan.

2010 Mathematics Subject Classification: 91G80.
Keywords: American call option, stock loan, asymptotic behaviour, Crank-Nicolson.

P-05. A study of cylindrical shock wave in magnetogasdynamics using similarity method

Hariom Sharma*, Rajan Arora
Indian Institute of Technology Roorkee, India
hariomsharma002@gmail.com, rajanfpt@iitr.ac.in

In the present work we have taken one dimensional unsteady flow of non ideal gas with magnetic effect under the presence of thermal radiation. The system is hyperbolic in nature and solved by similarity method using Lie Group Transformations under the assumption that the system is constantly conformally invariant under the transformations. The similarity solutions are investigated behind a

cylindrical shock which is a consequence of a sudden explosion or produced by an expanding piston. The shock is assumed to be strong and propagating into the medium which is at rest, with uniform density. The total energy of the shock is assumed to be time dependent and obeying power law. By means of similarity method our system of PDEs transformed into the system of ordinary differential equations (ODEs), which in general are nonlinear. The effects on the the flow variables velocity, density, pressure and magnetic field are investigated behind the shock.

2010 Mathematics Subject Classification: 35Lxx, 76Lxx, 76Nxx.
Keywords: shock waves, lie group of transformation, similarity solutions, non ideal gas.

P-06. A variational method for volume-preserving multiphase mean curvature flow considering bulk energies

Rhudaina Z. Mohammad
Western Mindanao State University, Philippines 7000
mohammad.rhudaina@wmsu.edu.ph

We introduce a numerical scheme for realizing volume-preserving mean curvature motions of interfaces separating multiple phase regions with space-dependent bulk energy density. Our method is based on a vector-valued analogue of the MBO (Merriman-Bence-Osher) threshold dynamics. This level set approach allows our method to naturally handle interfaces that cross or have complicated topology. To alleviate the well-known MBO time and grid restrictions, we construct a signed distance vector field for our initial condition, which provides the needed subgrid accuracy on uniform meshes without adaptive refinement. Moreover, we adopt a variational method employing the idea of a vector-type discrete Morse flow, which allows us to easily treat volume constraint via penalization. We formally show that our method evolves the interface with a normal velocity equal to its minus mean curvature and the difference in bulk energies. We also present some numerical experiments to simulate rising gas bubbles in a liquid-filled container. Here, we incorporate the influence of pressure force in the parabolic framework where bulk energy density is taken as an energy potential.

2010 Mathematics Subject Classification: 53C44, 76T30, 35J20, 35R35.
Keywords: multiphase mean curvature flow, volume preservation, bulk energies, vector-valued signed distance, constrained variational method, MBO thresholding.

P-07. On the properties of some fractional derivatives and some applications

Ramon Vicente R. Agcaoili, Johnatan S. Pimentel, Marian P. Roque*
Institute of Mathematics, University of the Philippines Diliman
marian.roque11@gmail.com

Fractional calculus, the study of derivatives and integrals of non-integer order, started as a purely theoretical field but in the past few decades has developed as an alternative to integer order derivatives and integrals in the modelling of physical phenomena. There are several types of fractional differential operators in the current literature, among which the most widely utilized are the Riemann-Liouville fractional derivative(RLFD) and the Caputo fractional derivative(CFD). In a recent paper, Caputo and Fabrizio introduced the Caputo-Fabrizio fractional derivative (CFFD) which, in contrast to the RLFD and CFD, has a nonsingular kernel. We discuss the different properties of the CFFD and verify that it satisfies a set of criteria for fractional differential operators. Finally, we consider a graphical comparison between the classical and fractional solutions of mathematical models of some dynamical systems.

Keywords: fractional calculus, Riemann-Liouville fractional derivative, Caputo fractional derivative, Caputo-Fabrizio fractional derivative

S07. Probability and Statistics

Invited Talks

IT-01. Weighted L^2-statistics for testing goodness-of-fit

Ludwig Baringhaus, Bruno Ebner, Norbert Henze*
Inst. für Math. Stochastik, Universität Hannover, Inst. für Stochastik, KIT
lbaring@stochastik.uni-hannover.de, Bruno.ebner@kit.edu, Norbert.henze@kit.edu

For many decades, weighted L^2-statistics have been employed in numerous goodness-of-fit testing problems. In a one-sample setting, a weighted L^2-statistic takes the form

$$T_n = n \int_M Z_n^2(t)\, \mu(\mathrm{d}t),$$

where $M \subset \mathbb{R}^d$, μ is a finite measure on the Borel subsets of M, and $Z_n(X_1, \ldots, X_n, t)$ is a real-valued function of $\mathbb{R}^d$-valued random vectors. In a setting of i.i.d. copies $X_1, X_2, \ldots$ of a random vector X with unknown distribution function F, weighted L^2-statistics have been used to test a hypothesis of the type $H_0 : \mathbb{P}^X \in \mathcal{Q} := \{Q_\vartheta : \vartheta \in \Theta\}$, where $\mathbb{P}^X$ denotes the distribution of X, $\mathcal{Q}$ is some family of d-variate distributions indexed by some finite-dimensional parameter, but also for testing nonparametric hypotheses. Results on T_n usually involve a non-degenerate limit distribution, as $n \to \infty$, under H_0 and the limit law of T_n under contiguous alternatives to H_0. Moreover, under a fixed alternative to H_0, there is a stochastic limit of the type

$$\frac{T_n}{n} \xrightarrow{\mathbb{P}} \Delta(F) := \int_M z^2(t)\, \mu(\mathrm{d}t).$$

By using a Hilbert space approach we show that, under such alternative and general conditions, there is asymptotic normality

$$\sqrt{n}\left(\frac{T_n}{n} - \Delta(F)\right) \xrightarrow{\mathcal{D}} \mathrm{N}(0, \sigma^2(F)),$$

where $\sigma^2(F)$ can be estimated consistently. This opens the ground for an asymptotic confidence interval for $\Delta(F)$ and an asymptotic equivalence test that, for a given $\Delta_0 > 0$, tests the hypothesis $\Delta(F) \geq \Delta_0$ against $\Delta(F) < \Delta_0$. For the special case of the Cramér-von Mises distance $\Delta(F) := \int (F - F_0)^2 \mathrm{d}F_0$, where F and F_0 are univariate continuous distribution functions, we give a novel probabilistic representation of $\Delta(F)$.

2010 Mathematics Subject Classification: 62G10, 62G20, 62G15.
Keywords: weighted L^2-statistic, goodness-of-fit test, asymptotic confidence interval, asymptotic equivalence test, Cramér-von Mises distance.

IT-02. Bernstein reciprocal processes, their origin and uses in Mathematics, Natural Sciences and other fields

Jean-Claude Zambrini
Group of Mathematical Physics Univ. Lisbon.
jczambrini@fc.ul.pt

In 1932, S. Bernstein suggested the construction of a class of ("reciprocal") stochastic processes, motivated by a problem due to E. Schroedinger about the probabilistic foundations of quantum mechanics. In modern terms, these processes satisfy the local Markov property, but they appeared there in a context quite distinct from usual ones. Even when they are not Markovian or time homogeneous, they can preserve a kind of time symmetry. We shall describe the main features of these processes and some of their recent applications in various fields.

2010 Mathematics Subject Classification: 60G05, 60G44, 60H30, 60J60, 81P99.
Keywords: Bernstein's reciprocal processes, stochastic deformation (of mechanics), Path integrals.

IT-03. Navier-Stokes equation and stochastic forward-backward systems

Xin Chen[1], Ana Bela Cruzeiro*[2], Zhongmin Qian[3]
[1]Shanghai Jiao Tong University, China
[2]Dept. Mathematics, I.S.T., University Lisbon, Portugal
[3]Math. Institute, Univ. Oxford, UK of Great Britain and Northern Ireland
chenxin217@sjtu.edu.cn, abcruz@math.tecnico.ulisboa.pt, qianz@maths.ox.ac.uk

We consider stochastic forward-backward systems in infinite dimensional (Sobolev) spaces whose solutions provide solutions for the Navier-Stokes equation. We prove existence for this partial differential equation (globally for state space of dimension 2 and locally for higher dimensions) using probabilistic methods. We also show the convergence to solutions of Euler equation when the viscosity tends to zero.

2010 Mathematics Subject Classification: 60H30, 35Q30, 76D05.
Keywords: forward-backward systems, Navier-Stokes equation, vanishing viscosity limit.

IT-04. Stochastic dynamics in infinite dimensions related to random matrices

Hirofumi Osada
Kyushu University, Japan
osada@math.kyushu-u.ac.jp

We talk about stochastic dynamics whose (unlabeled) equilibrium states are point processes appearing in random matrix theory. These dynamics are called interacting Brownian motions (IBMs). We give various examples of IBMs related to random matrices. For example, sine, Airy, Bessel IBMs in one space dimension, and Ginibre IBM and stochastic dynamics related to zero points of planer Gaussian analytic functions (GAF) in two space dimensions. We construct these except GAF

as a pathwise unique strong solution of an infinite dimensional stochastic differential equation (ISDE). Our method is analytic, and based on stochastic analysis. We present a sequence of general theorems to solve ISDEs. We establish a new formulation of solutions of ISDEs in terms of tail σ-fields of labeled path spaces consisting of trajectries of infinitely many particles. These formulations are equivalent to the original notions of solutions of ISDEs, and more feasible to treat in infinite dimensions. If β-ensembles satisfy some moment bounds of n-particle approximations, then we can immediately obtain stochastic dynamics using the general theory. When $\beta = 2$ and $d = 1$, there exists another construction of stochastic dynamics based on space-time correlation functions, called the algebraic construction. Our method yields the same stochastic dynamics obtained by the algebraic construction. Analytic method gives qualitative information. If we would have a time, we will talk about the following as examples. (1) Girsanov-like formula for tagged particles of IBMs: The resulting IBMs are then locally same as Brownian motions. (2) Dynamical rigidity: Random point fields appearing in random matrix theory have various rigidities. We talk their dynamical counter parts and prove that their global behavior is very rigid and different from Brownian motions. We explain how geometric rigidity yields the dynamical rigidity for interacting Brownian motions in infinite dimensions arising from random matrix theory. This talk is based on the joint work with Hideki Tanemura in Chiba University.

2010 Mathematics Subject Classification: 60K35, 60H10, 82C22, 60B20.
Keywords: random matrices, infinite-dimensional stochastic differential equations, interacting Brownian motions, determinantal point processes.

IT-05. Estimating the intensity of a cyclic Poisson process in the presence of linear, quadratic and power function trends

I Wayan Mangku
Department of Mathematics, Bogor Agricultural University
wayan.mangku@gmail.com

The problems of estimating the intensity function of a cyclic Poisson process in the presence of respectively linear trend, quadratic trend and a power function trend are considered. Estimator of the intensity function in each case is constructed and investigated. We do not assume any parametric form for the cyclic component of the intensity function, except that it is periodic. Moreover, we consider the case when there is only a single realization of the Poisson process is observed in a bounded interval. The proposed estimators are proved to be weakly and strongly consistent when the size of the observation interval indefinitely expands. Asymptotic approximations to the bias and variance of the proposed estimators are computed. Some open problems also will be presented.

2010 Mathematics Subject Classification: 62E20, 62G20, 62M20.
Keywords: cyclic Poisson process, consistency, asymptotic bias, asymptotic variance.

IT-06. Bounds in total variation distance for Markov chains and random walks

Ian Flint, Nicolas Privault*, Giovanni Luca Torrisi
Nanyang Technological University, CNR Rome
{iflint, nprivault}@ntu.edu.sg, torrisi@iac.rm.cnr.it

Given two discrete-time stochastic processes with laws $\mathbb{P}$ and $\widetilde{\mathbb{P}}$ on a finite state space, we derive a bound on the total variation distance $\mathrm{dTV}(\mathbb{P}, \widetilde{\mathbb{P}})$ in terms of the cylindrical projections of $\mathbb{P}$ and $\widetilde{\mathbb{P}}$. This result is then specialized to Markov chains and to random walks with not necessarily independent increments. Our proof relies on the predictable representation of multidimensional normal martingales.

2010 Mathematics Subject Classification: 60J10, 60J05, 60G50, 60G42, 15A69.
Keywords: total variation distance, Markov chains, random walks, normal martingales, obtuse random walks.

IT-07. Dense and sparse graph limits arising from respondent driven sampling

Adrian Röllin
National University of Singapore
adrian.roellin@nus.edu.sg

Sampling from large networks is of great statistical importance, since rarely is the full network available to the practioner. One particular procedure that has been frequently implemented (and often criticised) is the so-called "respondent driven sampling" (also called "snowball sampling"), where participants are asked for referrals, which in turn are again asked for referrals and so on. It has been well-known that this type of sampling will introduce biases, which are determined by the degrees of the nodes in the network. We give a dense and sparse graph limit version of this phenomenon under various implementations of respondent driven sampling. This is joint work with Siva Athreya (ISI Bangalore) and will appear in *Annals of Applied Probability*.

2010 Mathematics Subject Classification: 05C80, 60J20, 37A30.
Keywords: dense graph limits, respondent driven sampling.

IT-08. The motion of a tagged particle in the simple exclusion process

Dayue Chen
Peking University, China
dayue@pku.edu.cn

The simple exclusion process is an interacting particle system. There is no birth or death of particles. Each particle perform an independent random walk. The walk is suspended when a particle jumps to the site of another particle. Therefore a tagged particle behaviors very much like a random walk with a fixed rate of slow down. In this talk we shall review some limit theorems of a tagged particle in the simple exclusion and report our progress in this direction.

2010 Mathematics Subject Classification: 60K35.
Keywords: exclusion process, tagged particle, random walk.

Contributed Talks

CT-01. Bayesian estimation of random parameter response models of skew-normally distributed stimuli: evidence from Monte Carlo simulation

Mohammad Masjkur*[1], Henk Folmer[2,3]
[1]Department of Statistics, Bogor Agricultural University, Indonesia
[2]Faculty of Spatial Sciences, University of Groningen, The Netherlands
[3]Dept. of Agricultural Economics, Northwest AF University, China
masjkur@gmail.com

Random effects dose-response models have been found to outperform their fixed effects counterparts. The former are usually based on the assumption that the stimuli are normally and symmetrically distributed. The purpose of this paper is to analyze Bayesian inference of random parameter response models in the case of stimuli with skewed heavy tailed distributions by way of Monte Carlo simulation.

Method We examine the bias and Root Mean Squared Error (RMSE) of the Bayesian estimator under the assumptions of skew-t (Student's t distribution) and normality in the case of (1) skewed heavy tailed normally distributed stimuli (2).normally and symmetrically distributed stimuli generated according to the nonlinear Spilmann-Mitscherlich (SMM) and the linear Quadratic (QMM) mixed model, respectively. For case 1, we generate stimuli with skewed heavy tailed distribution. For case 2, we generate normally and symmetrically distributed stimuli. For each of the 100 simulated data sets, the Spilmann-Mitscherlich random parameter model was estimated under the assumption that (1) the density of random effects was the skew-t and the density of the residuals the t distribution (St), (2) the random effects are skew-normally (SN) and the residuals normally distributed (N), and (3) the random effects and the residual are normally distributied.

Results and Discussion For the linear Quadratic random parameter model the same three cases were analyzed. We use a Bayesian estimation method based on Markov Chain Monte Carlo algorithms to obtain posterior estimates of the parameters. Results show that for the nonlinear Spilmann-Mitscherlich and linear Quadratic data with skewed heavy tailed distribution, we find that the relative bias and RMSE of the Bayesian estimator under the assumption of normality (N-SMM and N-QMM) are larger than under the assumption skew-normality (SN-SMM and SN-QMM) and skew-t (St-SMM and St-QMM)) with the St-SMM and St-QMM models having the smallest values for all sample sizes (T) and for the three variance sizes. However, for all models the relative bias and RMSE increase with increasing variance of the random effects, but decrease with increasing T. Thus, the Bayesian estimator under the skew-t is more accurate and efficient than the normal and the skew-normal counterparts model to estimate parameters of skewed heavy tailed data. For case 2, we find that for small T, on average, the relative bias of the Bayesian estimator under normality is similar to the Bayesian estimator under the skew-normal and the skew-t model for both SMM and QMM. However, as T and the variance increase the relative bias and RMSE of the Bayesian estimator under the skew-t model is smaller than under the normal and the skew-normal. This result indicates that the Bayesian estimator under the skew-t is more robust than its counterparts under the normal and skew-normal to estimate parameters of normal data.

2010 Mathematics Subject Classification: 62C10.
Keywords: Bayesian estimation, random parameter model, skew-normal independent distribution, skew-t distribution, heavy-tailed distribution, linear and nonlinear model, dose response model.

CT-02. Estimating DEA efficiency using uniform distribution

MD. Kamrul Hossain, Anton Abdullah Kamil*
School of Distance Education, Universiti Sains Malaysia, 11800 USM, Penang
anton@usm.my

The most commonly used non-parametric tool for measuring the relative efficiency of Decision Making Units (DMU) is Data Envelopment Analysis (DEA). In this article, a method for measuring the efficiency level of a DMU when it is in an unfavourable situation as well as estimating the efficiency using uniform distribution is shown. The efficiency score from the traditional BCC-DEA model and the efficiency score in an unfavourable situation form an interval. This interval, known as interval efficiency, is used to estimate efficiency using uniform distribution. In an empirical example, a 95 percent confidence interval(CI) is calculated for the efficiency score using a three-point estimation method. The analysis indicated that the efficiencies that were estimated from uniform distribution are all within the confidence interval. In addition, a statistical test shows that there is no significant different between the estimated efficiency and the efficiency from DEA.

2010 Mathematics Subject Classification: 62H10.

Keywords: interval efficiency, data envelopment analysis, uniform distribution, three-point estimation.

CT-03. Wavelet recurrent neuro fuzzy for time series forecasting model

Nanang Hermawan*, Dedi Rosadi
Department of Mathematics, Gadjah Mada University, Indonesia
nanang.hermawan@mail.ugm.ac.id, dedirosadi@gadjahmada.edu

In this paper, we discuss Wavelet Recurrent Neuro Fuzzy for time series forecasting model to improve Fuzzy Inference System. A High learning ability of the Recurrent Neural Network will be used to implement the membership functions of Fuzzy Inference System. Combination of Wavelet, Neural Network, and Fuzzy will be conducted to form the dynamical and nonli-near nonparametric forecast model. Denoising using Wavelet Haar will be proposed to capture significant information from the data. Subsequently, Elman Recurrent Neural Network, which is a network with feedback, will be used as a training model in first-order Sugeno in Fuzzy Inference System. This nonlinear and nonparametric model is expected to be a simple model that can generate an accurate time series data prediction.

2010 Mathematics Subject Classification: 62M10.
Keywords: denoising, Fuzzy Inference System, Haar wavelet, recurrent neural network.

CT-04. Construction an isometric stochastic flows on Gromoll-Meyer exotic sphere

Nurfarisha*[1], Adhitya Ronnie Effendie[2], Muhammad Farchani Rosyid[1]
[1]Department of Physics, Universitas Gadjah Mada, Yogyakarta, Indonesia
[2]Department of Mathematics, Universitas Gadjah Mada, Yogyakarta, Indonesia
{nurfarisha, adhityaronnie, farchani}@ugm.ac.id

In this paper, examined the concrete form of isometric stochastic flows on Gromoll-Meyer exotic sphere Σ^7_{GM}. The possibility of an incomplete vector field in the stochastic processes − solution of stochastic differential equation related exotic differential structure is discussed. The concept of the incompleteness vector field is a result of the chosen exotic − Σ^7-valued isometric stochastic flows ϕ_t with the same point motion. Milnor exotic spheres Σ^7 is discussed through Gromoll-Meyer exotic spheres model, Σ^7_{GM}, of an exotic sphere as a quotient of the Lie group $Sp(2)$ of quaternionic unitary matrices with respect to an explicit S^3 action. The work is one of the concrete cases attempting to build the foundation of isometric stochastic flows on an exotic manifold.

2010 Mathematics Subject Classification: 46N30, 37A50, 58J65, 60H10, 60J60.
Keywords: stochastic, isometric stochastic flows, Gromoll-Meyer exotic sphere.

CT-05. Survival regression analysis of networked infectious data

Oyelola A. Adegboye
Dept. of Mathematics, Physics and Statistics, Qatar University, Doha, Qatar
o.adegboye@qu.edu.qa

Network data is a special kind of correlated data in which measurements are correlated from one or multiple networks. Often during infectious disease outbreaks, transmission of disease may form networks of infected individuals because of the way the virus crossed from infected individuals to susceptible ones. This study is based on a retrospective analysis of the Middle East respiratory syndrome coronavirus (MERS-CoV) outbreak in the Arabian Peninsula between June 6, 2012 and May 19, 2015. Of the 958 cases recorded during the study period more than 90% (866) of the disease incidence occurred in the Kingdom of Saudi Arabia while Kuwait has the least incidence. Seventeen percent of those infected with MERS disease were heath care worker. The fatality for the disease is about 0.35 among the total population. The distribution of the age of the infected persons was 50 ± 18 years, with large percentage of them (55%) reported that they have had some kind of comorbidity. The infected individuals form network of individuals connected by source of infection (contact) as direct or indirection connection. We will introduce a flexible dependence model that reflect the relationship among infected individuals in the same network.

2010 Mathematics Subject Classification: 62N99, 62-07, 62P05.
Keywords: survival, network, regression, infectious disease, MERS-CoV.

CT-06. A new approach in constructing spatial dependence of space time series through an adjacency matrix

Utriweni Mukhaiyar
Statistics Research Division, Institut Teknologi Bandung, Indonesia
utriweni@math.itb.ac.id

Spatial weight matrix is an important element in space time modeling. It represents spatial dependency among locations. Most of methods used in defining this matrix are purely based on real distance matrix. As two location's distance is closer, the spatial dependence between both will be greater. It will be fixed all the time, while technologies and information are developing rapidly, so that spatial dependency which are just influenced by its distance will be inappropriate. This study propose a new approach in constructing a spatial weight matrix of a GSTAR model which consider the correlation among time series of locations. Spatial weight is built based on the locations closeness through an adjacency matrix. It is concluded that this approach give an update spatial dependency of locations.

2010 Mathematics Subject Classification: 62M10, 62M30.
Keywords: spatial weight, correlation, time series, spatial dependency, adjacency matrix.

CT-07. Infrastructure of transportation and communication as a basic estimation of quality of life in urban area (case study in central Java Province)

Sri Subanti*[1], Inaki Maulida Hakim[2], Arif Rahman Hakim[3,4]
[1]Center for Research and Development for Tourism, Sebelas Maret University
[2]Department of Industrial Engineering, University of Indonesia
[3]Faculty of Economics and Business University of Indonesia
[4]Institute for Research and Social Services Sebelas Maret University
sri_subanti@yahoo.com, {inakimaulida.hakim, arhaqkm}@gmail.com

This paper aims to calculate of quality of life based on transportation and communication infrastructure. Indicator for transportation infrastructure, i.e road condition, length of road, and availability of public transportation; then indicator for communication infrastructure, i.e availabilty of television signals, post services, wartel, and warnet (warung internet). This paper used data from (1) national economy and social survey (SUSENAS) and (2) potential of village (called Potensi Desa atau Podes). Both of the data reached from Central Bureau of Statistics. For technique estimation, we used ordinary least squared method. This study found that, city of Tegal reached highest ranking for quality of life in Central Java Province. Our recomendation, regional governments have to give a priority for infrastructure, because it contributes for quality of life in urban area.

2010 Mathematics Subject Classification: 90B06.
Keywords: infrastructure, transportation, telecommunication, quality of life, urban area, central java province

CT-.08 Change of scale formulas for conditional Fourier-Feynman transforms over continuous paths II

Dong Hyun Cho
Department of Mathematics, Kyonggi University, Suwon 16227, Republic of Korea
j94385@kyonggi.ac.kr

Let $C0,T]$ denote a generalized Wiener space, the space of real-valued continuous functions on the closed interval $[0,T]$. Let $a \in C[0,T]$, h be of bounded variation with $h \neq 0$ a.e. on $[0,T]$ and define a stochastic process $Z : C[0,T] \to \mathbb{R}$ by

$$Z(x,t) = \int_0^t h(s)dx(s) + x(0) + a(t)$$

for $x \in C[0,T]$ and for $t \in C[0,T]$. Define a random vector $Z_n : C[0,T] \to \mathbb{R}^{n+1}$by

$$Z_n(x) = (Z(x,t_0), Z(x,t_1), \cdots, Z(x,t_n)),$$

where $0 = t_0 < t_1 < \cdots < t_n < T$ is a partition of $[0,T]$. Using a simple formula for generalized conditional Wiener integrals on $C[0,T]$ with the conditioning function

Z_n, we evaluate a generalized analytic conditional Fourier-Feynman transform and a convolution product of cylinder function having the form

$$F_r(x) = f\left(\int_0^t v_1(s)dZ(x,s), \cdots, \int_0^t v_r(s)dZ(x,s)\right)$$

for $x \in C[0,T]$, where $f \in L_p(\mathbb{R}^r)$ with $1 \le p \le \infty$ and $\{v_1, \cdots, v_r\}$ is an orthonormal subset of $L_2[0,T]$. We then investigate relationships between the transform and convolution, and establish various change of scale transformations for the generalized analytic conditional Fourier-Feynman transform of G_r with Z_n. In the evaluation formulas and scale transformations we use a multivariate normal distribution so that the orthonormalization process of the proiections $\mathcal{P}^{\perp}hv_1, \cdots, \mathcal{P}^{\perp}hv_r$ can be removed in the existing change of scale formulas.

2010 Mathematics Subject Classification: 28C20, 46F12, 60G15.
Keywords: analogue of Wiener space, analytic conditional Fourier-Feynman transform, change of scale formula, conditional convolution product, Wiener space

CT-09. Model spatial disease mapping with under reported data (multiple approach)

S. Padmadisastra*, J. Suprijadi, N. Sunengsih
Department of Statistics, Universitas Padjadjaran, Indonesia
{paksepti, jadisuprijadi, nenks.stat}@gmail.com

A spatial model of disease mapping is discussed in this paper. This model is an extension of disease mapping model with under reported data developed in Padmadisastra and Suprijadi (2015). In this paper we add a spatial effect, in terms of correlation between region, into their model. We use multivariate car modelling to describe the behaviour of the vector parameter; i.e relative risk (θ) and probability of being reported, (p). The results is tried to empirical data of dengue fever in Bandung city for the year 2013.

2010 Mathematics Subject Classification: 62H11.
Keywords: under reported, disease mapping, relative risk, multivariate car model.

CT-10. A survey of kernel-type estimators for copulas and their applications

I Wayan Sumarjaya
Department of Mathematics, Udayana University, Indonesia
sumarjaya@unud.ac.id

Copulas have been widely used to model nonlinear dependence structure. Main applications of copulas include areas such as finance, insurance, hydrology, rainfall to name but a few. The flexibility of copula allows researchers to model dependence structure beyond Gaussian distribution. Basically, a copula is a function that joins multivariate distribution functions to their one-dimensional marginal

distribution functions. In general, there are three methods to estimate copulas. These are parametric, nonparametric and semiparametric methods. In this article we survey kernel-type estimators for copulas such as mirror reflection kernel, beta kernel, transformation method and local likelihood transformation method. Then, we apply these kernel methods to two datasets: major stock indexes in Asia and weather data from NCDC-NOAA. The results of our analysis suggest that, albeit variation in information criterion values, the local likelihood transformation method performs better than the other kernel methods.

2010 Mathematics Subject Classification: 62G07, 62G99, 62P05, 62Q99.
Keywords: copula, empirical copula, kernel method, nonparametric estimation method.

CT-11. Kalman filter for better forecasting

Erna Apriliani, Endah Putri, Nuri Wahyuniningsih
Institut Teknologi Sepuluh Nopember, Indonesia
aprilmath12@gmail.com, {endahrmp, nuri}@matematika.its.ac.id

Forecasting or prediction is an important and familiar method to know the event in the future time, such as weather, option price, inflation, price of petroleum and others. Usually, we collect some time series data of our problem. Base on those time series data, we make Box-Jenkins ARIMA model and we do forecasting based on Box-Jenkins ARIMA model. ARIMA model can be written as

$$Z_t = \phi_1 Z_{t-1} - \theta_1 a_{t-1} + a_t + \eta_t.$$

Suppose the measurement data at time t is Z_t^d, the forecasting at time t is Z_t and $\tilde{Z}_t = Z_t - Z_t^d$ is the error of forecasting. Here, we assume the error of forecasting has polynomials form $\tilde{Z}_t = c_0 + c_1 Z_t^d + c_2 Z_t^{d^2}$. We estimate the parameters c_0, c_1, c_2 by using Kalman filter and we do forecasting by $Z_t = \phi_1 Z_{t-1} - \theta_1 a_{t-1} + a_t + \tilde{Z}_t$. So, by using Kalman filter we make the forecasting better and we call this method ARIMA Kalman Filter. In the ARIMA Kalman filter, we define the system

$$x_{k+1} = Ax_k + Gw_k$$

where A is identity matrix;$x_k = \begin{pmatrix} c_0 & c_1 & c_2 \end{pmatrix}^T$; G is matrix, and It is assumed w_k is Gaussian white noise with mean zero and covariance Q_k. The measurement equation is

$$\tilde{Z}_k = \begin{pmatrix} 1 & z_k & z_k^2 \end{pmatrix} x_k$$

To verify the accuration of this method, we apply ARIMA Kalman filter method to forecast the air temperature, speed of wind, water level of river and inflation. From those simulation, we conclude that ARIMA Kalman filter has more accurate for forecasting, the order polynomials of error influence the accuration of forecasting.

2010 Mathematics Subject Classification: 60G15.
Keywords: error forecasting, ARIMA, Kalman filter.

CT-12. A bivariate approach in modeling two-dimensional warranty with imperfect preventive maintenance

Hutomo A. Maulana*[1], Udjianna S. Pasaribu[1], Hennie Husniah[2]
[1]Departement of Mathematics, Institut Teknologi Bandung, Indonesia
[2]Departement of Industrial Engineering, Langlangbuana University, Indonesia
hutomomaulana@gmail.com, udjianna@math.itb.ac.id, hennie.husniah@gmail.com

A warranty for product which considering only operating time may not be adequate since the product deteriorate through age and usage. This paper develops a two-dimensional warranty for repairable product by considering both age and usage. There are two type of customers who will be considered, costumers whose the warranty ended because usage limit or time limit has reached first. The proposed model uses bivariate approach on the Weibull process and failure rate reduction method to analyze the breakdown process in terms of time and usage. When the age or usage of equipment reaches a specified limit, an imperfect preventive maintenance is conducted. Furthermore, when the equipment fails, a minimal repair corrective maintenance is performed. A penalty occurs to manufacture if time to rectify a failure exceed a specified limit. As an illustration, a numerical example is performed to calculate number of breakdowns and optimal preventive maintenance degree. This paper will compare for independent and dependent case for first failure distribution through numerical simulation to demonstrate the effectiveness of the proposed approach.

2010 Mathematics Subject Classification: 62P30, 60E05.
Keywords: two-dimensional warranty, bivariate approach, preventive maintenance, imperfect repair.

CT-13. A multi item probabilistic inventory model

Dharma Lesmono, Taufik Limansyah
Universitas Katolik Parahyangan
{jdharma, taufiklimansyah}@unpar.ac.id

In this paper, we develop a mathematical model for an inventory problem which consists of several products. Demands for these products are following Gamma distribution. Our objective is to determine the optimal ordering quantity that minimizes the total cost of each product. This is called an individual replenishment policy. The total cost consists of the purchasing cost, ordering cost, handling and shortage costs. All shortages are back-ordered. Using the same model, we also develop a periodic review model that determines an optimal ordering time for all products. This is called a joint replenishment policy. We then compare the total cost of the individual and joint replenishment policy and determine a policy which gives the minimum total cost. Our numerical experiments show that in general the joint replenishment policy is preferable than the individual replenishment policy. The joint replenishment policy gives higher shortage cost, but less in ordering and handling costs compared to the individual replenishment policy.

2010 Mathematics Subject Classification: 90B05.
Keywords: multi item, individual replenishment policy, joint replenishment policy.

CT-14. Overflow loss system analysis for optimal bed allocation in a hospital in Yogyakarta Indonesia

A.I. Endrayanto[1], Gunardi[1], F. Adi Kusumo[1], R.J. Boucherie[2], N.M. van de Vrugt[2]
[1]Dept. of Mathematics, Universitas Gadjah Mada, Yogyakarta, Indonesia
[2]Stochastic Operations Research, University of Twente, Enschede, the Netherlands
{endrayanto, gunardi, f_adikusumog}@ugm.ac.id, {r.j.boucherie, n.m.vandevrugtg}@utwente.nl

In this paper, we develop a model for bed allocation problems under the new Mandatory Health Insurance Scheme (*Jaminan Kesehatan Nasional* - JKN) managed by the Indonesia's Social Security Organising Body (*Badan Penyelenggara Jaminan Sosial* - BPJS). We propose an overflow queueing with repacking model for bed allocation model: when a patient of class j arrives and finds all N_j beds are occupied, he/she will be put in another class and will be put back immediately to his/her original class as soon as a bed available. We obtain a product form expression of the blocking probability of the bed allocation of class i patient. Furthermore, we calculate the expected revenue of the hospital under the BPJS-JKN heath insurance. Using the model, we develop a capacity planning tool to maximize the total revenue. As a numerical example, we will apply our model the case in a hospital in Yogyakarta, Indonesia.

2010 Mathematics Subject Classification: 00A71.
Keywords: bed allocation, overflow with repacking model, BPJS-JKN, Rumah Sakit UGM.

CT-15. Bivariate logistic regression modeling

M. Fathurahman*[1,2], Purhadi[1], Sutikno[1], Vita Ratnasari[1]
[1]Dept. of Statistics, Institut Teknologi Sepuluh Nopember Surabaya Indonesia
[2]Dept. of Mathematics, University of Mulawarman Samarinda, Indonesia
fathurstat@gmail.com, {purhadi, sutikno, vita_ratna}@statistika.its.ac.id

Logistic regression model is widely used by researchers for analyzing categorical data in various field. Bivariate logistic regression model is an extension of univariate logistic regression model with two response variables. The aim of this study is bivariate logistic regression modeling for binary response. Bivariate logistic regression model for binary response is often referred to as bivariate binary logistic regression (BBLR) model. Maximum Likelihood Estimation (MLE) method is applied to estimate BBLR model parameters. Maximum Likelihood Ratio Test (MLRT) method for testing BBLR model parameters. BBLR model is applied to the case of human development index and public health development index of districts/cities in Papua Province 2013. The results showed that estimator of BBLR model parameters were non-closed form. Statistical test of BBLR model for simultaneously and partially testing were approached by chi-square distribution. Based

on BBLR model, factors that significantly affect human development index and public health development index at the districts/cities in Papua Province 2013 are percentage of people who graduated from higher education and percentage of poor people.

2010 Mathematics Subject Classification: 62J12, 62H12, 62H15.
Keywords: BBLR model, MLE, MLRT.

CT-16. Application of universal kriging for predicting coal ash content using GStat R

Annisa Nur Falah, Betty Subartini, Budi Nurani Ruchjana*
Department of Mathematics, Universitas Padjadjaran, Indonesia
annisanurfalah02@gmail.com, [2)]bettysubartini@yahoo.com, bnurani@gmail.com

In the universe, the air is a natural resource that is a very big function for living beings. The air is a gas mixture contained in a layer that surrounds the Earth and the components of the gas mixture is not always constant. During the time a lot of air pollution caused by industrial waste, coal ash pollution is an example of pollution that can pollute the environment and damage the health of humans. To solve this problem we need a method that is able to predict pollutant coal ash content in locations that are not observed.

In geostatistics, we can use the universal kriging for prediction in a location that is not observed. Universal kriging is an interpolation method that has a tendency trend (drift) or a particular valuation method used to deal with non-stationary sample data. GStat is a program based on R software that can be used to predict pollutant coal ash in a location that is not observed by the method of universal kriging. In this study, we predicted coal ash content using trend (drift) equation of first order. GStat application program in the prediction of coal ash pollutants provides faster computation, more accurate, convenient and can be used as a recommendation for policy makers in the field of environment.

2010 Mathematics Subject Classification: 86A32
Keywords: non-stationary, trend ($drift$), universal kriging, GStat.

CT-17. Parameter estimation of exponentiated modified Weibull extension distribution

Christian Beren*, Sri Astuti Thamrin, Andi Kresna Jaya
Department of Mathematics, Hasanuddin University, Indonesia
statchristianberen@gmail.com, tuti@unhas.ac.id, andikresna@yahoo.com

Survival analysis is a statistical method for analyzing the life time of an individual or a particular unit to an event. The commonly used distribution in analyzing the life time data is Weibull distribution and it is flexible in modeling failure time data, as the corresponding hazard function can be increasing, decreasing or constant. However, it is unable to model the non-monotonic hazard function such as

bathtub-shaped hazard. Exponentiated Modified Weibull Extension (EMWE) distribution introduced to analyze the data set with bathtub-shaped hazard function. In this paper, we use total time on test (TTT) plot to test whether the data have the bathtub-shaped hazard. EMWE distribution has four parameters which consist of two scale parameters and two shape parameters. These parameters are estimated by maximum likelihood estimation (MLE) method, followed by Berndt-Hall-Hall-Hausman (BHHH) iteration method. This is illustrated by using the simulated data. The result of this study indicates that the data follow the EMWE distribution. We can also observe that the data exhibits the bathtub-shaped hazard rate.

2010 Mathematics Subject Classification: 62N01, 62N02, 62F15.
Keywords: Bathtub-shaped, Berndt-Hall-Hall-Hausman, exponentiated modified Weibull extension, Hazard function, Kolmogorov Smirnov, maximum likelihood estimation, total time on test plot.

CT-18. On stochastic logistic equation driven by fractional Brownian motion

Herry Pribawanto Suryawan*, Boby Gunarso
Department of Mathematics, Sanata Dharma University, Yogyakarta, Indonesia
herrypribs@usd.ac.id, bobygunarso@hotmail.com

Fractional Brownian motion appears naturally in the modeling of many real-world problems. The short/long-range memory of fractional Brownian motion is of interest in the study in communication networks, theoretical physics, probability, statistics, hydrology, biology, and many others. In particular, the increments of fractional Brownian motion with Hurst parameter greater than one half are positively correlated, and therefore the process is persistent. In the other hand, the lack of Markovian and martingale properties makes the analysis of this process and related models is challenging. This paper discusses a stochastic logistic equation driven by fractional Brownian motion with Hurst parameter greater than one half. The existence, uniqueness, and stability (in the sense of Lyapunov) of solutions of the equation are studied.

2010 Mathematics Subject Classification: 60H10, 60H30, 60G22
Keywords: stochastic logistic equation, fractional Brownian motion

CT-19. Pricing multi-asset equity options driven by a multidimensional variance gamma process under nonlinear dependence structures

Komang Dharmawan
Dept. of Mathematics, Udayana University, Indonesia
k.dharmawan@unud.ac.id

This paper explore the dynamic properties of a multidimensional Variance Gamma process, which has non Gaussian marginal features and no linear dependence structure. We use dynamic copula functions to specify the dependence

structure of underlying assets. We study the effect of different choices for the dependence functions to the prices of a set of multi-asset equity options. We model the market using Variance Gamma process together with a d-dimensional geometric Brownian motion. The analysis is conducted using 5-dimensional baskets that consist of Jakarta Stock Exchange Composite Index (IHSG) and four other Asian Indexes, Hang Seng, Nikkei, KOSPI, Straits Times Index (STI) and a standard payoff functions for multi-asset options. We compare the result with the non dynamic dependence structure.

2010 Mathematics Subject Classification: 60G51, 60G57, 60J75
Keywords: Levy Process, Multivariate Variance Gamma, Dependence Structure, Multivariate Asset Modeling

CT-20. The application of cat swarm optimization algorithm in classifying small loan performance

Eka N. Kencana*[1], Nyoman Kiswanti[2], Kartika Sari[2]
[1]Tourism Research Consortium - Udayana University, Indonesia
[2]Department of Mathematics - Udayana University, Indonesia
{i.putu.enk, mangkisz}@gmail.com, sari_kaartika@yahoo.co.id

It is common for banking system to analyse the feasibility of credit application before its approval. Although this process had been carefully done, there is no warranty that all credits will be repaid smoothly. This study aimed to know the accuracy of Cat Swarm Optimisation (CSO) algorithm in classifying small loan performance of Bank Rakyat Indonesia (BRI), one of several public banks in Indonesia. Data collected from 200 lenders were used to measure the accuracy of CSO. The data matrix consists of 10 independent variables relate to profile of the credit and one categorical-dependent variable reflects credit's performance.

Prior to the analyses, data was divided into 2 data set with equal size. Applying ordinal logistic regression (OLR) procedure to first data set, 3 out of 10 independent variables i.e. the amount of credit, credit's period, and income per month of lender proved significantly affect credit performance. By using estimated parameters from OLR procedure as the initial values for observations at the second data set, CSO procedure started. This procedure gave us 76 percent of classification accuracy of credit performance, a slightly better compared to 64 percent resulted from OLR procedure.

2010 Mathematics Subject Classification: 68W25, 97K80.
Keywords: classification, CSO, optimisation, regression.

CT-21. Classification of inhibitor with enhanced inhibitor database using logistic regression ensemble approach

Heri Kuswanto*[1], Jainap Niken[1], Yogi Sarumaha[1], Hayato Ohwada[2]
[1]Dept.of Statistics-Institut Teknologi Sepuluh Nopember, Indonesia
[2]Dept.of Industrial Administration-Tokyo University of Science Japan, Japan
heri_k@statistika.its.ac.id, {jainapniken, yogi.sarumaha}@gmail.com, ohwada@rs.tus.ac.jp

The process of finding proper drug composition is a complex work which needs long process and expensive cost. In silico method has been proven to be one of effective drug design alternatives with less expensive cost. To deal with this, the purpose of the design is to find potential inhibitors. This research examines three targeted enzymes on enhanced Database of Useful Decoys (DUD-E) and classifies the inhibitors as decoy or ligand. The docking score is predicted using a relatively new classification method namely Logistic Regression Ensemble (LORENS) which is developed specifically for classification of high dimensional data. The fact that the enzymes consists of large number of compounds leads to the inapplicability of parametric logistic regression. Moreover, there is also an issue of imbalance response in the dataset. LORENS solves this problem by estimating the optimal threshold as the basis of classification. The LORENS outperforms the parametric logistic regression by generating slightly higher classification accuracy.

2010 Mathematics Subject Classification: 62G32, 62G09, 62G10
Keywords: LORENS, logistic, accuracy, imbalance.

CT-22. Almost marginal conditional stochastic dominance (AMCSD) and its application in forming efficient portofolios

Isnandar Slamet*, Siska Mardiana Putri Carissa, Hasih Pratiwi
Study Program of Statistics, Sebelas Maret University, Indonesia
isnandar06@yahoo.com, siskacarissa95@gmail.com, hpratiwi@mipa.uns.ac.id

Investors choose an efficient portfolio which is a portfolio that has a maximum return for specific risk or minimal risk for specific return. Efficient portfolios can be formed using almost marginal conditional stochastic dominance (AMCSD) criteria. In this paper, we investigate the AMCSD criteria and apply AMCSD criteria to form an efficient portfolio of bank shares listed in the LQ-45. This AMCSD criteria is used when there are areas that do not meet the criteria of marginal conditional stochastic dominance (MCSD). The criteria can be calculated from quotient of areas that do not meet the MCSD criteria with the areas that meet or do not meet the MCSD criteria. Based on evaluating on the data of bank shares listed on LQ-45, we conclude that there are 38 efficient portfolios of 420 portfolios with each portfolio has 4 shares and 315 efficient portfolios of 1710 portfolios with each portfolio has 3 shares.

2010 Mathematics Subject Classification: 62P05,91G70.
Keywords: almost marginal conditional stochastic dominance, portfolio.

CT-23. Stick-breaking prior on Bayesian mixture-based general regression neural network

Achmad Syahrul Choir*[1], Brodjol S. S. Ulama[1], Nur Iriawan[1], Mohammad Dokhi[2]
[1]Dept. of Statistics, Institut Teknologi Sepuluh Nopember (ITS), Indonesia
[2]Institute of Statistics (STIS), Jakarta, Indonesia
madsyair@bps.go.id, {brodjol_su, nur_i}@statistika.its.ac.id, dokhi@stis.ac.id

Mixture-Based General Regression Neural Network (MBGRNN) is neural network that developed based on mixture model. To address overfitting issue in MBGRNN, we propose new method for selecting number of hidden neurons by the use of stick-breaking prior. This prior is one type of Dirichlet Process prior that is applied to determine number of components in Bayesian mixture modelling. Supposed MBGRNN formula:

$$y = \frac{\sum_{j=1}^{m} v_j w_j \exp\left(-\frac{1}{2}\sum_{k=1}^{p}\left(\frac{x_k-\mu_{jk}}{h_k}\right)^2\right)}{\sum_{j=1}^{m} w_j \exp\left(-\frac{1}{2}\sum_{k=1}^{p}\left(\frac{x_k-\mu_{jk}}{h_k}\right)^2\right)} + \varepsilon$$

where $\varepsilon \sim N(0, \sigma^2)$. Priors of parameter are $v_j \sim H, H|\alpha \sim \mathrm{DP}(\alpha H_0), H_0 = N\left(v_0, \delta\lambda^2\right)$, $\mu_{jk} \sim G_k, G_k|\alpha \sim \mathrm{DP}(\alpha G_{0k}), G_{0k} = N\left(\mu_{0k}, d_k {h_k}^2\right)$ and w_j are constructed by 'stick-breaking'. Thus set $q_m = 1$, $q_j \sim \mathrm{Be}(1, \alpha)$ where j=1...m-1, and set $w_1 = q_1$, $w_2 = q_2(1-q_1)$,..., $w_m = q_m(1-q_{m-1})(1-q_{m-2})...(1-q_1)$. Markov Chain Monte Carlo (MCMC) algorithm was applied to estimate MBGRNN parameter under Bayesian framework. We explained with simulated and real data. Small value of w_j indicates j-th hidden neuron can be discarded from the model, so that number of hidden neuron can be selected.

2010 Mathematics Subject Classification: 65C05, 62F15, 92B20.
Keywords: MBGRNN, Bayesian, neural network, Dirichlet process, MCMC.

CT-24. Hierarchical time series buttom-up approach for forecast export value in Central Java

Dani Al Mahkya, Brodjol Sutijo Suprih Ulama, Suhartono
Sepuluh Nopember Institute of Technology, Indonesia

The purpose of this study is to forecast export value in Central Java using Bottomup approach of Hierarchical Time Series. The data and forecasts are organized in a hierarchy based on disaggregating the data for different commodity. The concept of Bottom up approach is generating base independent forecasts for each series at the bottom of hierarchy and then aggregating these upwards to produce revised forecasts for the whole hierarchy. There are three method that used in this study such as Autoregressive Integrated Moving Average (ARIMA) method, Backpropagation Neural Network (BPNN) and Radial Basis Function Neural Network

(RBFNN). The ARIMA models is one of popular method on time series modelling to forecast. This model used to explain the problems of stationary or non-stationary time series. The BPNN models is one of neural network (NN) which had multilayer perceptron (MLP) architecture. The MLP consists of one input layer, one or more hidden layers and one output layer. The BPNN models use Binary Sigmoid activation function from the input layer to the hidden layer, while from the hidden layer to the output layer uses a Linear activation function. As with BPNN, the architecture of RBFNN is also MLP, but only had one hidden layer. The Activation function used from the input layer to the hidden layer is Gaussian activation function. To check the accuracy of the result used Mean Absolute Percentage Error (MAPE). After that, the result of prediction used to aggregate these upwards and produce revised forecast for up level.

2010 Mathematics Subject Classification: 62M10.
Keywords: Export Value, Hierarchical Time Series, Buttom-up Approach, ARIMA, BPNN, RBFNN.

CT-25. Tripartite graph analysis on network of active compound-target protein-disease in elucidation of jamu working mechanism

Muchlishah Rosyadah*[1], Farit Mochamad Afendi[1], Wisnu Ananta Kusuma[2]
[1]Department of Statistics, Bogor Agricultural University, Indonesia
[2]Department of Computer Science, Bogor Agricultural University, Indonesia
lisha.rosyadah@gmail.com, fmafendi@ipb.ac.id, w.ananta.kusuma@gmail.com

Jamu is traditional medicine in Indonesia, made from various parts of plants, such as: plants, roots, flowers, seeds, leaves and fruits. Differs from the concept of one drug-one target in chemical drugs, jamu have a concept of multi components-network target. It is caused by the involvement of many plant's active compound in jamu that targeted multiple proteins in human body. Network connecting active compound and target protein, added with diseases related to the proteins, provides a solid foundation useful in elucidating computationally the Jamu working mechanism. The Jamu is designed for T2D and consist of 4 plants, namely: Bitter melon *(Momordica charantia)*, Sembung *(Blumea balsamifera)*, Bratawali *(Tinospora crispa)*, and Ginger *(Zingiber officinale)*. The procedure for network construction was as following. Step 1, linking the plant's active compounds and all their target proteins. Step 2, connecting target proteins with those related diseases obtained from Disgenet database, the PharmGKB database, and Therapeutic Target Database. There are 47 active compounds obtained from Ginger, 4 active compounds from Sembung, 4 active compounds from Bitter melon, and 3 active compounds from Bratawali. So there are 58 total active compounds obtained from the four plants. A connection between active compounds and target proteins generated 395 unique proteins. And the result from step 2 indicated that 395 proteints related to multiple diseases, most of them have Neoplasms (15.9%), Nervous System Diseases (9.6%), Digestive System Disease (9.2%) and Cardiovascular Diseases (7.7%). A Network of active compound-target protein-diseases will be analysed us-

ing Tripartite Graph Analysis to elucidate a jamu woking mechanism.

2010 Mathematics Subject Classification: 37A50.
Keywords: active compound, disease, tripartite graph, jamu

CT-26. The comparison of econometric models to estimate spillover effect by means of Monte Carlo simulation

I Gede Nyoman Mindra Jaya*[1], Henk Folmer[2,3], Budi Nurani Ruchjana[4]
[1]Statistics Department, Padjadjaran University, Indonesia
[2]Faculty of Spatial Science, University of Groningen, The Netherlands
[3]College of Eco. & Management, Northwest Agriculture & Forestry Univ., China
[4]Mathematics Department, Padjadjaran University, Indonesia
jay.komang@gmail.com, h.folmer@rug.nl, bnurani@gmail.com

Studies on spatial econometric model has been developed covering from estimation method, selection of appropriate weight matrix **(W)** and the issue of spatial spillover. In regional science, spatial spillovers are the main interest. They can be defined as the impact of changes to explanatory variables in a particular unit i on the dependent variable values in other units $j (i \neq j)$. The spatial spillover appears because there are endogenous interaction effects among the dependent variable and exogenous interaction effects among the explanatory variables. There are several spatial econometrics model that have been used to cover those interaction effects i.e. General Nesting Spatial model (GNS), Spatial Autoregressive Combined model (SAC), Spatial Durbin Error Model (SDEM), Spatial Durbin Model (SDM), Spatial Autoregressive Model (SAR) and Spatial Lag of X model (SLX). Compared to the other models, the last model, is the simplest model proposed to estimate spatial spillover effect Vega et al (2015) have compared this model to estimate the spillover effect based on empirical study. This paper tries to make a general conclusion of a better model to estimate the spillover effect based on minimum bias and mean square error of regression and spillover effect. The comparison has been done by Monte Carlo Simulation using several conditions. The SDM model is the simplest model which can explain the spillover effect easier and results in minimum bias.

2010 Mathematics Subject Classification: 91B72, 62J05.
Keywords: Monte Carlo, SLX, spatial econometric, spillover.

CT-27. Using partitioned design matrices in analyzing nested-factorial experiments

Sigit Nugroho
University of Bengkulu, Indonesia
snugroho@unib.ac.id

Calculating the sum of squares using QR Decomposition requires the number of observations has to be greater than the total number of parameters used in the

model. As an alternative, partitioned design matrix method may be used to calculate the sum of squares and the degrees of freedom for each source of variations. Such partitioned is discussed in the Nested-Factorial Experimental Design.

2010 Mathematics Subject Classification: 62K02, 62K04, 62K07.
Keywords: partitioned design matrices, nested factorial, sum of squares, degrees of freedom.

CT-28. The application of conjoint analysis by thurstone procedure on Sekolah Tinggi Ilmu Statistik students preference of the lecture quality

Fitri Catur Lestari
Sekolah Tinggi Ilmu Statistik, Indonesia
fitricaturlestari@stis.ac.id

The quality of higher education is determined in part by the quality of lecturers. Expectations of the quality of lecturers is more precisely measured by students who are the parties directly involved in the lectures. Measurement expectations of students on the quality of lecturers can be done using analysis of preference. In the field of statistics have been known analysis examines the special preferences that called as conjoint analysis. Steps in conjoint analysis are to formulate the problem, designing stimuli, determine the method of data collection, choose the procedure conjoint analysis, and interpretation of results. This approach to design stimuli in this study is a combination of pairs (pairwise comparison) or two-factor evaluation. While the data collection methods and procedures used conjoint analysis is an interview with rank response and Thurstone procedure. The method of withdrawal the samples is purposive sampling method with sample selection was based equalization in segments that allegedly there are different preferences of the students on the quality of lecturers ie GPA, level / grade, high school origin, gender, and parents income. Based Relative Value Important (NRP) and the value scale, the preference of students to faculty is mastering quality course materials, ability to motivate students, self carriage, delivery of content and teaching methods. Preference of students to faculty quality vary depending on the segment of the CPI, the level / grade, high school origin, gender, and parents income. Students who have a high GPA particularly liked lecturers who master the material. While students who have a lower GPA really liked humorist lecturers. The first level students prefer lecturers who motivates students than humorist lecturers. In contrast, the fourth level students prefer a humorous lecturers rather than a lecturer motivates students. The high-school students who came from Jakarta is more like a humorous lecturers. While high-school students who came from outside Jakarta is prefer a lecturer who is able to motivate his students. Male students prefer communicative lecturers(presenting the material in both directions) than the lecturers who likes to motivate students. While female students on the contrary, is more like a lecturer who likes to motivate students than communicative ones. Students whose parents have low incomes prefer lecturer motivates students. While students whose parents have high incomes seems more like a humorous lecturer.

2010 Mathematics Subject Classification: SS07-482.
Keywords:conjoint analysis, Thurstone, pairwise comparison, preference.

CT-29. Relative risk estimation of dengue disease in Bandung, Indonesia using poisson-gamma and BYM models considering the level of the severity

Farah Kristiani, Benny Yong*
Department of Mathematics, Parahyangan Catholic University, Indonesia
{farah, benny_y}@unpar.ac.id

Recently, dengue as the most dangerous disease in the world, needs more attention to be prevented in its transmission. One method that is usually used is through the statistics approach to estimate the relative risks of dengue transmission. The dengue cases of all severity levels spread rapidly in every district in Bandung, Indonesia every month. Therefore, the early-stage known as Dengue Fever (DF), the severe-stage manifested as Dengue Haemorrhagic Fever (DHF) and Dengue Shock Syndrome (DSS), and both stages combined, would be taken into account and investigated in this research. The non-spatial Poisson-gamma model and spatial Besag, York, and Mollie (BYM) model are applied to estimate the relative risks in each district in Bandung every month. This research will use the data in year 2013 from St. Borromeus hospital as one of the reputable hospitals in Bandung. From the results obtained, it can be concluded that the implementation of non-spatial Poisson-gamma and spatial BYM models does not depict a significantly different result in estimating the relative risks of dengue transmission in Bandung. This analysis is also applicable to every stage estimated, both for the early-stage as well as the severe-stage. Therefore, it can be concluded that there is no spatial effect in dengue transmission in Bandung.

2010 Mathematics Subject Classification: 62F15, 62P10.
Keywords: dengue, Bandung, Poisson-gamma, BYM, relative risk.

CT-30. The comparison of three methods conjoint analysis based on respondent time to determine the choice of stimuli cards

Fitri Catur Lestari
Sekolah Tinggi Ilmu Statistik, Indonesia
fitricaturlestari@stis.ac.id

There are many types of method in conjoint analysis such as fullprofile design with ranking response (method A), fullprofile design with rating response (method B) and pairwise comparison with ranking response (method C). It is necessary to evaluate and compare them based on the result and the respondent time to determine their choice. The purposive sampling method had been used to select 125 students as research samples. The cosideration of samples selection is based on the segments that supposed as representative the population such as GPA, level

/ grade, high school origin, gender, and economic status (income) of the parents. There are different result of three methods of conjoint analysis: student's preference of lecturer quality in method A and C are mastery of course material, ability to motivate students, character, communication and teaching method. While the method B, the sequence attributes that prefer are mastery of lecture, character, communication, ability to motivate students, and learning method. By 95% confidence level paired t test, the result are: there are significant duration (time) differences between three methods (p value= 0.000), the method A is a method with the longest time for students to finished it and in contrast, the method C is a method in the shortest time for students to finished it.

2010 Mathematics Subject Classification: SS07-556.
Keywords: fullprofile design, ranking response, rating response, pairwise comparison.

CT-31. Spatial pattern analysis and spatial autocorrelation in economics growth in East Java

Noviyanti Santoso*, Sutikno
Department of Statistics ITS, Indonesia
noviyantisantoso30@gmail.com

Velocity of economics growth is one of indicators to determine economics state in particular region. It can be measured by comparing the increased national income annually. As the biggest province in Indonesia, East Java performs plausible economics growth. Using spatial pattern analysis and spatial autocorrelation, we can obtain the pattern and dependencies of velocity of economics growth in East Java. The result of this study provides the pattern of velocity of economic growth distributed uniformly. Whereas Morans I test show that there is no spatial autocorrelation in that matter. On the other hand it is locally concluded that region with spatial autocorrelation are Tulungagung, Kediri, Sidoarjo, Madiun, Sampang, and Pamekasan.

2010 Mathematics Subject Classification: 62H11.
Keywords: velocity, economics growth, spatial analysis.

CT-32. Multivariate rainfall disagregation with Bayesian mixture of multi-output neural networks

Kartika Fithriasari*, Nur Iriawan, Brodjol S. S. Ulama
Dept. of Statistics, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
kartikafithriasari@gmail.com, {nur_i, brodjol_su}@statistika.its.ac.id

One way of hourly rainfall forecasting is the disagregation from daily rainfall data to hourly raifall data. Temporally, rainfall data in the current has nonlinearity relationship with rainfall data in the past. Rainfall data has skewed distribution and has two clusters, therefore Bayesian mixture of multi-output neural network (BMNN) model with adjusting procedures would be proposed to in this paper.

These methods had been applied to rainfall modeling at Pabelan and Jatisrono stations, Central Java, Indonesia. The result shows that BMNN with adjusting procedure outperforms the BMNN. The MSE of the BMNN with adjusting procedure for Jatisrono and Pabelan stations are 30 and 6 percent smaller than those of the BMNN.

2010 Mathematics Subject Classification: 62F15, 92B20.
Keywords: adjusting procedure, Bayes, rainfall, mixture models, neural network.

CT-33. Intangible heritage for sustainable future: mathematics in the coastal area

Stanley Dewanto, Dianne Amor, Budi Nurani Ruchjana, Atje Setiawan Abdullah
Department of Mathematics, Universitas Padjadjaran
{pdewanto.mpd, amor, budi.nurani, atje.setiawan}@unpad.ac.id

Mathematics, as the only general language, can describe all phenomena on earth. Mathematics not only helps us to understand these phenomena, but it also can sustain human activities, consequently ensure that the future development is sustainable. Indonesia, with high cultural diversity, should aware to have its understanding, skills, and philosophies developed by certain societies, with long histories of interaction with their natural surroundings, which will provide a foundation for locally appropriate sustainable development. This paper will discuss the condition and situation on certain coastal area in Cipatujah, West Java, Indonesia, and what skills, knowledge, and concept can be transmitted, regarding mathematics. Some examples are provided.

2010 Mathematics Subject Classification: 00A06.
Keywords: intangible heritage, mathematics, sustainable development.

CT-34. The method of mean value theorem for integrals to approximate renewal integral equations

Leopoldus Ricky Sasongko*, Tundjung Mahatma
Satya Wacana Christian University, Indonesia
{leopoldus.sasongko, t.mahatma}@staff.uksw.edu

In the analysis of warranty, renewal functions which are derived from the convolution method are important in acquiring the expected number of failures of a nonrepairable system or component in a time interval. It is very difficult -if at all possible- to obtain a renewal function analytically. This paper proposes a numerical method for approximating renewal functions in the terms of their integral equations, called the renewal integral equations. The approximation is done through the mean value theorem for integrals after modifying the variable of the renewal integral equations. The accuracy of the approximation is measured by its comparison against the existing exact renewal functions, namely the Normal and Gamma renewal functions. The renewal integral equation approach on the

Weibull distribution is done and compared to the well-known numerical approach, the Riemann-Stieljies method.

2010 Mathematics Subject Classification: 97I50.
Keywords: renewal functions, renewal integral equations, mean value theorem for integrals.

CT-35. Analytic approximations for American partial barrier options

Doobae Jun*[1], Hyejin Ku[2]
[1]Department of Mathematics, Gyeongsang National University, Korea
[2]Department of Mathematics and Statistics, York University, Canada
doobae.jun@gmai.com, hku@mathstat.yorku.ca

The valuation problem of American partial barrier option is considerd. Because a wide variety of traded options are American type, the problem of valuing American options has been an important topic in financial economics. However, the literature of American option has proposed only numerical solution methods and analytic approximations. This paper adopts the barrier approximation method under a exponential exercise policy, and provides an analytic approximation as the finite sum of bivariate normal distribution functions.

2010 Mathematics Subject Classification: 91G20, 60G40.
Keywords:analytic solution, American option, barriers, chained option, optimal exercise.

CT-36. The impact of censored survival data on Bayesian analysis when fitting a mixture of Weibull models

Sri Astuti Thamrin*[1], James McGree[2], Nicole White[2] Kerrie Mengersen[2]
[1]Department of Mathematics, Hasanuddin University, Indonesia
[2]School of Mathematical Sciences, Queensland University of Technology, Australia
tuti@unhas.ac.id, {james.mcgree, nm.white, k.mengersen}@qut.edu.au

The impact of censored survival data on Bayesian inference is assessed when estimating Bayesian Weibull mixture models through a simulation study and an application to microarray data. The simulation study was carried out with different parameter configurations of the mixture model, that is, two well-separated components and two strongly overlapping components for data generation each with five different levels of censoring. The Bayesian approach via Markov Chain Monte Carlo was used to estimate the parameters of Weibull mixture model. The issue of label switching and model evaluation are also considered.

2010 Mathematics Subject Classification: 62N01, 62N02, 62F15.
Keywords: Bayesian modelling, censored data, Markov Chain Monte Carlo, mixture model, survival analysis, Weibull distribution.

CT-37. Modeling the fair market price of Sukuk Ijarah in Indonesia

Dedi Rosadi*[1], Heni Wahyuni[2], Sri Redjeki[3]
[1]Department of Mathematics, Gadjah Mada University, Indonesia
[2]Department of Economics, Gadjah Mada University, Indonesia
[3]STMIK AKAKOM, Indonesia
{dedirosadi, hwahyuni}@ugm.ac.id, dzeky@akakom.ac.id

Shariah financial products are currently developing in Indonesia financial market. One of the most important products is called as Sukuk which is commonly referred to as "sharia compliant" bonds. The type of Sukuk that have been widely traded in Indonesia until now are Sukuk Ijarah and Sukuk Mudharabah. In this paper, we discuss various models for the price of the fixed-non-callable Sukuk Ijarah and provide the empirical studies using data from Indonesia Bonds market. Based on the empirical results, we recommend the most suitable model for the fair market price of Sukuk Ijarah in Indonesia.

2010 Mathematics Subject Classification: 91G70, 91G80.
Keywords: Sukuk Ijarah, non callable, bonds, fair price.

CT-38. Mean-variance portfolio optimization by using non constant mean and volatility base-on risk tolerance

Endang Soeryana Hasbullah*[1], Nurfadhlina bt Abdul Halim[2], Sukono[1]
Endang Rusyaman[1], Sudradjat Supian[1]
[1]Dept. of Mathematics Universitas Padjadjaran, Indonesia
[2]School of Informatics and Applied Mathematics Universiti Malaysia Terengganu
endangsoeryana@yahoo.co.id, lina@umt.edu.my, fsukono@yahoo.com, ndangrosya@yahoo.co.id, adjat03@yahoo.com

Investment in Islamic stocks investors are also faced with the issue of risk, due to daily price of stock also fluctuate. To minimize the level of risk, investors usually forming an investment portfolio. Establishment of a portfolio consisting of several stocks are intended to get the optimal composition of the investment portfolio. This paper discussed about optimizing investment portfolio of Mean-Variance to stocks by using mean and volatility is not constant approaches. Non constant mean analyzed using models Autoregressive Moving Average (ARMA), while non constant volatility models are analyzed using the Generalized Autoregressive Conditional heteroscedastic (GARCH). Optimization process is performed by using the Lagrangian multiplier technique. As a numerical illustration, the method is used to analyze some Islamic stocks in Indonesia. The expected result is to get the proportion of investment in each Islamic stock analyzed.

2010 Mathematics Subject Classification: 91B30, 91G10, 91G70.
Keywords: investment risk, portfolio Mean-Variance, ARMA models, GARCH models, Lagrangian multiplier.

CT-39. Valuation of reload call option with binomial tree

Yunita Wulan Sari*, Gunardi
Department of Mathematics, Universitas Gadjah Mada, Indonesia
yunita-ws@ugm.ac.id

Along with the rapid growth of investment and finance, the investors compete with each other to find a way to maximize profits and minimize losses. In option trading, one of the ways used is adding a reload feature on the option. Reload option is option that give the right to its holder to exercise the option, then renew it at some time prior to maturity. In this research, we study how to determine the pricing of reload call option with the Black-Scholes stock price model and the binomial tree, then applied to the stock of Telekomonikasi Indonesia (TLKM.JK). From this study, we obtain the valuation of reload call option which is simple and easy in interpretation. In addition we can also conclude that if the time to maturity is longer, the price of reload call option is more expensive and if the exercise price is higher, the price of reload call option is cheaper.

2010 Mathematics Subject Classification: 62P05.
Keywords: option, reload option, reload call option, Black-Scholes stock price model.

CT-40. Estimation of heteroscedasticity semiparametric regression curve using fourier series approach

Rahmawati Pane, Sutarman, Agus Salim Harahap
Dept. of Mathematics, University of Sumatera Utara, Indonesia
rahmawati10@mhs.statistika.its.ac.id, sutarman@usu.ac.id, hrpmat@yahoo.com

Heteroscedasticity semiparametric regression model contains two main components, i.e. parametric component and nonparametric component. Heteroscedasticity semiparametric regression model assumes the data (x_i', z_i, y_i) following the model, $y_i = x_i'\beta + f(z_i) + \sigma_i\varepsilon_i,\ i = 1, 2, \cdots, n$ where y_i is response variable. It is assumed to have a linear relationship with the predictor variables $x_i' = (x_{i1}, x_{i2}, \ldots, x_{ir})$ but the predictor variables $z_i = (z_{1i}, z_{2i}, \ldots, z_{pi})$ of unknown shape relationship patterns. $x_i'\beta$ of the parametric component with

$$\beta = (\beta_0, \beta_1, \beta_2, \cdots, \beta_r)' \in \mathbf{R}^r$$

represents the size of parameter vector $r \times 1$. Random error $\varepsilon_i,\ i = 1, 2, \cdots, n$ is normally distributed with zero mean and variance σ^2, and $f(z_i)$ is a nonparametric component which is unknown function and assumed to be contained in the continuous functions space $C[0, \pi]$. In this paper, we use Fourier series $f(z) = bz + \frac{1}{2}a_0 + \sum_{k=1}^{K} a_k \cos kz$ as the component of nonparametric regression curve $f(z_i)$. The estimation of heteroscedasticity semiparametric regression curve obtained by completing optimization of Weighted Penalized Least Square (WPLS) as follows:

$$\mathrm{Min}_{f \in C(0,\pi)} \left\{ n^{-1}(y - \mathrm{X}\beta - f)'\mathrm{W}(y - \mathrm{X}\beta - f) + \lambda \int_0^{\pi} \frac{2}{\pi}[f''(z)]^2\, dz \right\}$$

The results of this study showed that the estimation of parametric component is $\hat{\beta} = (X'WX^{-1})X'y$ while the estimation of nonparametric component is $\hat{f}_\lambda(z) = H(\lambda)y$ for $H(\lambda)$ matrix which depends on bandwidth parameters λ.

2010 Mathematics Subject Classification: 62J05, 42B05.
Keywords: fourier series, heteroscedasticity semiparametric regression, bandwidth parameter, WPLS.

CT-41. Estimator truncated spline nonparametric regression in the geographically weighted regression model

Sifriyani*[1], Haryatmi[1], Budiantara[2], Gunardi[1]
[1]Gadjah Mada University, [2]Institut Teknologi Sepuluh Nopember, Indonesia
sifriyani@mail.ugm.ac.id, s_kartiko@yahoo.com, i_nyoman_b@statistika.its.ac.id
gunardi@mail.ugm.ac.id

Truncated spline nonparametric regression in the geographically weighted regression model is a development of the nonparametric regression which takes into account the location or spatial. Truncated Spline approach can be solution to solve the problem of modeling spatial data analysis, if the data patterns between the response variable and the predictor variable is unknown or regression curve is not known. Originality of this research is has not been found research that develops and writing a paper about the nonparametric regression in the geographically weighted regression model (GWR). This study focused on finding nonparametric regression estimator with approach truncated spline in geographically weighted regression model. Optimization methods used are maximum likelihood estimator (MLE) weighted, the geographical weighted used in this study is a quadratic kernel weighted function.

2010 Mathematics Subject Classification: 62G08.
Keywords: GWR, nonparametric regression, MLE, truncated spline, quadratic kernel weighted.

CT-42. Detection of distribution of hotspots in West Kalimantan using the ordinary kriging method

Dadan Kusnandar*, Naomi Nessyana Debataraja
Department of Statistics, Tanjungpura University, Indonesia
dkusnand@untan.ac.id, naominessyana@math.untan.ac.id

Forest and land fires are commonly occurred in the peat land area of West Kalimantan. Wild fires have destroyed the forest and disturb almost the whole province and neighboring locations. This paper proposed a method to detect potential hotspots and their level of confidence that can be used as an early warning system. In this study we applied ordinary kriging method to 291 coordinates of hotspots and their level of confidence in September 2015. The data cover hotspots from seven districts of West Kalimantan. This study resulted in millions of coordinates of hotspots and their level of confidence that can be predicted as potential hotspots.

2010 Mathematics Subject Classification: 374.
Keywords: spatial data, geostatistics, burning intensity

CT-43. Parameter estimation and hypothesis testing on geographically weighted gamma regression model

Dina Eka Putri*, Purhadi, Dedy Dwi Prastyo
Dept. of Statistics, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
msdinaputri@gmail.com, {purhadi, dedy-dp}@statistika.its.ac.id

Gamma regression is a nonlinear regression used to model relationship between one or more independent variables and a positive continuous dependent variable that follows gamma distribution. Having applied to observations from different location, the gamma regression yields parameters which are assumed to be valid in any location. In fact, each location may have different characteristics such that the existence of spatial effect needs to be considered. In such a case the parameters of gamma regression are less representative. Thus, Geographically Weighted Gamma Regression (GWGR) plays into role. GWGR is a local form of gamma regression that considers the spatial effect, i.e. longitude and latitude of point observations.

This study aims to estimate parameters of GWGR model using Maximum Likelihood Estimation (MLE) method along with to test the significance of those estimated parameters. As the MLE method could not produce solution analytically, a numerical optimization method using Broyden-Fletcher-Goldfarb-Shanno (BFGS) algorithm was employed to estimate the parameters. In addition, Cross Validation (CV) was used to determine the optimum bandwidth in Kernel weight function. GWGR model was expected to report better fitting than the gamma regression did. Therefore a similarity model checking using F-test was employed to evaluate the performance of those two models. Once the parameter estimation was done, the hypothesis testing procedure was used to test the significance of independent variables within the model, both partially using Z-test and simultaneously using Maximum Likelihood Ratio Test (MLRT).

2010 Mathematics Subject Classification: 62F10, 62F03, 62J02.
Keywords: Gamma regression, geographically weighted gamma regression, BFGS algorithm, maximum likelihood ratio test.

CT-44. Tourism prediction using Box-Jenkins ARIMA model

Roxanne Daphne O. Lapaan*, Rizavel C. Addawe
Matthew Angelo M. Eugenio, Aujen Eymard K. Briones
University of the Philippines Baguio, Philippines
{rolapaan, rcaddawe}@up.edu.ph

This study used Univariate Box-Jenkins Autoregressive Integrated Moving Average (UBJ-ARIMA) modelling to make a forecast on the number of tourist arrivals in Baguio City, the Province of Benguet, and the Cordillera Administrative Region

(CAR) located in the Northern part of the Philippines. The same method was also used to make a forecast of the percentage of the number of tourists in Baguio City with respect to CAR. The data used was acquired from the Department of Tourism, CAR Office which consists of the number of tourist arrivals recorded in the past 15 years (2001-2015) obtained from hotels and inns of the covered areas. The resulting models for the tourist arrivals in Baguio City, the Province of Benguet, and CAR are ARIMA$(0,1,1)(0,1,0)_{12}$, ARIMA$(1,1,2)(0,0,1)_{12}$, and ARIMA$(2,1,1)(0,1,1)_{12}$, respectively. For the percentages of the number of tourists in Baguio City over CAR, the yielded model was ARIMA$(0,1,1)$.

2010 Mathematics Subject Classification: 62M10, 60G10, G2M20.
Keywords: univariate Box-Jenkins, ARIMA, forecasting, time series analysis.

CT-45. Forecasting Philippine daily stock exchange index

Jackie D. Urrutia[1], John Lean B. Diaz[2], Edcon B. Baccay[2]
[1]Polytechnic University of the Philippines - Sta. Mesa Campus, Philippines
[2]Polytechnic University of the Philippines-Para naque Campus, Philippines
jdurrutia@pup.edu.ph, djlean1998@gmail.com, ebbaccay@pup.edu

The purpose of the study is to produce models that can forecast the Philippine Daily Stock Exchange Index from the year 1995 until 2014 for the entire 4927 observations. Three year total future values will be forecasted using the Time Series Analysis Seasonal Autoregressive Integrated Moving Average (SARIMA) models. SARIMA or the Box- Jenkins Method will be used in identification of the model comprising the seasonality testing, and estimation of the model which include the unit root testing through the Augmented Dickey-Fuller Test for the stationarity of data series and other plotted basis of identifying and estimating the model. By then, Actual and Predicted Values will be compared through the paired t-test analysis by testing the hypothesis whether the two series of values are having significant difference or not, and other analyses signifying the accuracy of the model to forecast the future values, that is created through all the processes that are included in the evaluation of the model. This study may help the government for generating well-informed decisions regarding the topic discussed and for any improvements they may be able to make in the Stock Exchanged shares in the Global Market for the countrys sake after learning about the possible outcome of the study.

2010 Mathematics Subject Classification: 91B84.
Keywords: SARIMA models, stock exchange.

CT-46. Strict solutions to stochastic linear evolution equations in Banach spaces

Vĩt Tôn TẠ*[1], Yoshitaka Yamamoto[2], Atsushi Yagi[3]
[1]Promotive Center for International Education and Research of Agriculture, Faculty of Agriculture, Kyushu University, Japan
[2]Dept. of Information and Physical Sciences, Osaka University, Japan
[3]Dept. of Applied Physics, Osaka University, Japan
tavietton@agr.kyushu-u.ac.jp, yamamoto@ist.osaka-u.ac.jp, atsushi-yagi@ist.osaka-u.ac.jp

In this paper, we study a non-autonomous stochastic linear evolution equation $dX + A(t)Xdt = F(t)dt + G(t)dW(t)$ in a Banach space of M-type 2. We construct unique strict solutions to the equation on the basis of the theory of deterministic linear evolution equations. The abstract results are applied to stochastic diffusion equations.

2010 Mathematics Subject Classification: 60H15, 35R60, 47D06.
Keywords: analytical semigroups, stochastic linear evolution equations, strict solutions, M-type 2 Banach spaces.

CT-47. Rainfall prediction of Cimanuk watersheds regions with canonical correlation analysis

Shailla Rustiana*[1], Sinta Berliana Sipayung[2], Budi Nurani Ruchjana[3], Atje Setiawan Abdullah[4], I Gede Nyoman Mindra Jaya[5], Krismianto[2], Eddy Hermawan[2]
[1]Geophysic and Meteorology Department of IPB, Indonesia
[2]Atmospheric Science and Technology Center of LAPAN Bandung, Indonesia
[3]Department of Mathematics Universitas Padjadjaran, Indonesia
[4]Department of Computer Science Universitas Padjadjaran, Indonesia
[5]Department of Statistics Universitas Padjadjaran, Indonesia
{shailla.rustiana, s_berlianasipayung}@yahoo.com
{bnurani, atjesetiawan, jay.komang, krismianto.lapan}@gmail.com, eddy_lapan@yahoo.com

Rainfall prediction in Indonesia is very influential on various development sectors, such as agriculture, fisheries, water resources, industry, and other sectors. The inaccurate predictions can lead to negative effects. Cimanuk watershed is one of the main pillar of water resources in West Java. This watersheds divided into three parts, which is a headwater of Cimanuk sub-watershed, Middle of Cimanuk sub-watershed and downstream of Cimanuk sub-watershed.

The flow of this watershed will flow through the Jatigede reservoir and will supply water to the north-coast area in the next few years. So, the reliable model of rainfall prediction is very needed in this watershed. Rainfall prediction conducted with Canonical correlation Analisis (CCA) method using Climate Predictability Tool (CPT) software. The prediction is every 3months on 2016 (after January) based on Climate Hazards group Infrared Precipitation with Stations (CHIRPS) data over West Java. Predictors used in CPT were the monthly data index of Nino3.4,

Dipole Mode (DMI), and Monsoon Index (AUSMI-ISMI-WNPMI-WYMI) with initial condition January. The initial condition chosen by the last data update. While, the predictor were monthly rainfall data CHIRPS region of West Java.

The results of prediction rainfall showed by skill map from Pearson Correlation. High correlation of skill map are on MAM (Mar-Apr-May), AMJ (Apr-May-Jun), and JJA (Jun-Jul-Aug) which means the model is reliable to forecast rainfall distribution over Cimanuk watersheds region (over West Java) on those seasons. CCA score over those season prediction mostly over 0.7.

The accuracy of the model CPT also indicated by the Relative Operating Characteristic (ROC) curve of the results of Pearson correlation 3 representative point of sub-watershed (Sumedang, Majalengka, and Cirebon), were mostly located in the top line of non-skill, and evidenced by the same of rainfall patterns between observation and forecast. So, the model of CPT with CCA method is reliable to use.

2010 Mathematics Subject Classification: 37M10, 62H20
Keywords: CPT, Pearson correlation, ROC.

CT-48. Bivariate copula in drought modeling

Fadhilah Yusof*[1], Foo Hui-Mean[1], Zulkifli Yusop[2], Jamaludin Suhaila[1]
[1]Department of Mathematical Sciences, Universiti Teknologi Malaysia (UTM)
[2]Institute of Environmental and Water Resources Management, UTM
fadhilahy@utm.my, huimean87@gmail.com, {zulyusop, suhailasj}@utm.my

The drought characteristics can be described by a bivariate relationship between the main drought variables, namely severity and duration. A bivariate copula, which is a bivariate model of uniform distribution that links the joint probability distribution based on their univariate marginal distributions, is applied in this study to determine the association and dependency between the drought variables. Six copula distributions: Ali-Mikhail-Haq, Clayton, Frank, Galambos, Gumbel-Hougaard, and Plackett are tested with respect to daily rainfall data from selected rain gauge station in Malaysia. Using Akaike Information Criterion (AIC) as the goodness of fit test, the results show that the Galambos distribution is the most appropriate copula distributon to represent the bivariate relationship between these drought variables. To further justify the results obtained, simulation runs are generated and it was confirmed that the Galambos distribution has the best ability to capture the important characteristics of the observed drought variables. Finally, in describing the possibility of drought recurrent, the conditional distribution and joint return periods between drought severity and duration are determined in which the results obtained can be used as a precautionary measure to the authority in charge.

2010 Mathematics Subject Classification: 62.
Keywords: bivariate copula, Akaike Information Criteria (AIC), conditional distribution, joint return periods.

CT-49. Lattice path approach of M/G/1 queues with vacation

Isnandar Slamet*[1)], Ritu Gupta[2], Narasimaha R. Achuthan[2], Roger Collinson[2]
[1]Study Program of Statistics, Sebelas Maret University, Indonesia
[2]Department of Mathematics and Statistics, Curtin University, Australia
isnandar06@yahoo.com, R.Gupta@curtin.edu.au, achu-than@yahoo.com.au
R.Collinson@curtin.edu.au

We investigate the performance of $M/G/1$ queueing systems with vacation through lattice path approach and by approximating general service time distribution with Coxian 2-phase distribution. In this paper we present lattice path representation, lattice path enumeration and structural properties of the queueing system. The transition probabilities of transient solution and numerical illustration of computing the density using R are also presented.

2010 Mathematics Subject Classification: 60K25, 68M20
Keywords: lattice path approach, Coxian distribution.

CT-50. Continuous time Markov chain in modeling the spread of influenza disease

F. Novkaniza*, D. Aldila, M. Malik
Department of Mathematics, FMIPA, Universitas Indonesia, Indonesia
{fevi.novkaniza, aldiladipo, maulana.malik}@sci.ui.ac.id

Mathematical model with stochastic approach for Influenza disease spread with intervention of medical mask and supportive treatment will be discussed in this article. One of methods for formulating stochastic SIS epidemic models for influenza disease that relate directly to their deterministic counterparts is a Continuous Time Markov Chain (CTMC) model. In a CTMC model, time is continuous, but the state variable is discrete with transition probabilities are referred to as an infinitesimal transition probabilities. Assuming the total of human population is constant and $\Delta t \to 0$, there are only three possible changes in states from i, i.e. to $i+1, i-1$ or stay in i. Applying the Markov property and the infinitesimal transitional probabilities, a system of forward Kolmogorov differential equations is obtained. We derive a differential equation for the moment generating function (mgf) of total number for infected people $I(t)$. From the mgf, the moment of the distribution for $I(t)$ was calculated by making some assumptions regarding to normality distribution. The result was compared to deterministic model according to the number of infected people in time t. We find that expectation for number of infected people in time t from CTMC approach is always smaller than from deterministic model approach.

2010 Mathematics Subject Classification: 92D30, 91B70
Keywords: influenza, CTMC, deterministic, mgf

Poster Sessions

P-01. To pool or not to pool: a test for the poolability of panel data

Choji, Niri Martha*[1], DR.Sek Siok Kun[2], Datong, Godwin Monday[3]
[1]Department of Mathematics, Plateau State University, Bokkos, Nigeria
[2]School of Mathematical Science, Universiti Sains Malaysia
[3]Department of Mathematics, University of Jos, Nigeria
marthaniri@yahoo.com, sksek@usm.my, mallong2007@yahoo.com

Because knowing when to pool our data or when not to pool is a difficult decision to make, this paper presents a test of poolability of a set of panel data to enable us make the right decision when we are faced with the challenge of when to or when not to pool our data. The question of whether to pool the data or not naturally arises with panel data. This study is focused on the use of the Levene's test to find out whether a set panel of data is poolable or not. We conducted the test on a set of panel data obtained from the World Bank, consisting of ten sub-Saharan Africa countries between the periods of 1996-2010 on the emission of Carbon-dioxide into the atmosphere. From the analysis, it was obvious that the data cannot be pooled because the hypothesis of equal variance was rejected. Therefore, we cannot run an Ordinary Least Squares (OLS) with the data, because if we do, our estimates will be inefficient.

2010 Mathematics Subject Classification: xxx.
Keywords: xxx.

P-02. New method for estimating the subset polynomial regression model by using reversible jump Markov chain Monte Carlo

Suparman
Mathematics Education Department, Ahmad Dahlan University, Indonesia
suparmancict@yahoo.co.id

Subset polynomial regression model is very flexible model to describe the data in various fields of life. Polynomial regression model is one part of a subset polynomial regression model. If the data is modeled by subset polynomial regression model, then the parameters must be estimated. Parameter models include a subset polynomial regression coefficients and error variance. This study aims to estimate the coefficients of the subset polynomial regression and the error variance. Regression coefficients and error variance are estimated in a Bayesian framework. Distribution prior for a subset polynomial regression coefficients and error variance is selected. Then, prior distribution is combined with likelihood function of the data to get a posterior distribution. To resolve this problem, reversible jump MCMC (Markov Chain Monte Carlo) method is used. The result of this research paper is the Bayes estimator for the subset polynomial regression coefficients and

error variance can be determined by using reversible jump MCMC method. The advantage of this method is even though the order regression model is not known, the Bayes estimator can be calculated.

2016 Mathematics Subject Classification: 68U20, 65C05.
Keywords: reversible jump MCMC, subset polynomial, Bayesian.

P-03. The effect of correlation between responses in bi-response nonparametric regression using smoothing spline

Adji Achmad Rinaldo Fernandes
Depart.of Mathematics, Statistics Study Program, Universitas Brawijaya, Malang
fernandes@staff.ub.ac.id

Studies on nonparametric regression model that developed at this time focus on single response model approach for longitudinal data, or multi-responses model approach for cross section data. This study will be developed spline estimators in biresponses nonparametric regression for longitudinal data which accommodates correlation between observations of the same subject, and correlation between each response. Initial study focused on the spline estimators form development and optimum smoothing parameters to estimate biresponses nonparametric regression curve in longitudinal data. In the final section, the result of theoretical study was applied on simulation data with situation of differences in the level of correlation. Biresponses nonparametric regression model which involved p predictors in longitudinal data, the estimators were expressed as follows: $\underset{\sim}{f}(x) = \mathbf{T}^{*}\underset{\sim}{d}^{*} + \mathbf{V}^{*}\underset{\sim}{c}^{*}$. While spline estimators which met the criteria of minimizing Penalized Weighted Least Square (PWLS):

$$\min_{f_{\ell ki}\in \mathrm{W}_2^m[a_{\ell ki},b_{\ell ki}],k=1,2;\ \ell=1,2,...,p;i=1,2,...,N} \left\{ M^{-1}\left(\underset{\sim}{y}-\underset{\sim}{f}\right)^{\mathrm{T}}\mathbf{\Sigma}^{-1}\left(\underset{\sim}{y}-\underset{\sim}{f}\right) + \sum_{k=1}^{2}\sum_{i=1}^{N}\lambda_{ki}\left[\sum_{\ell=1}^{p}\int_{a_{\ell ki}}^{b_{\ell ki}}\left[f_{\ell ki}^{(m)}(x_{\ell it})\right]^2 dx_{\ell it}\right]\right\}$$

were $\underset{\sim}{\hat{f}}_{\underset{\sim}{\lambda}} = \mathbf{T}^{*}\underset{\sim}{\hat{d}}^{*} + \mathbf{V}^{*}\underset{\sim}{\hat{c}}^{*} = \mathbf{A}_{\underset{\sim}{\lambda}}^{*}\underset{\sim}{y}$ with $\mathbf{A}_{\underset{\sim}{\lambda}}^{*} = \mathbf{T}^{*}\left(\mathbf{T}^{*\mathrm{T}}\hat{\mathbf{U}}^{-1}\hat{\mathbf{\Sigma}}^{-1}\mathbf{T}^{*}\right)^{-1}\mathbf{T}^{*\mathrm{T}}\hat{\mathbf{U}}^{-1}\hat{\mathbf{\Sigma}}^{-1} + \mathbf{V}^{*}\hat{\mathbf{U}}^{-1}\hat{\mathbf{\Sigma}}[\mathbf{I} - \mathbf{T}^{*}\left(\mathbf{T}^{*\mathrm{T}}\hat{\mathbf{U}}^{-1}\hat{\mathbf{\Sigma}}\mathbf{T}^{*}\right)^{-1}\mathbf{T}^{*\mathrm{T}}\hat{\mathbf{U}}^{-1}\hat{\mathbf{\Sigma}}$. Optimum smoothing parameters - $\underset{\sim}{\lambda}_{opt} = (\lambda_{11(opt)}, \lambda_{12(opt)}, ..., \lambda_{2N(opt)})'$ for biresponses nonparametric regression spline estimators in longitudinal data was obtained by minimizing function of GCV. Application on simulation data showed that: 1) Characteristics of exponential and trigonometric function of experiment yielded the highest level of accuracy, 2) the application of spline estimator of biresponses give the less effective in correlation level $|\rho|$ between 0.1-0.3. The use of variance-covariances matrix of random error

which accommodate the correlation between each responses usefulness in condition of correlation level $|\rho| > 0.3$. The higher level of correlation, the higher the R^2 level obtained.

2010 Mathematics Subject Classification: 41A15, 62G08.
Keywords: spline estimator, biresponses, correlation of each responses.

P-04. Universal portfolios generated by f-divergences

Choon Peng Tan, Kee Seng Kuang
Dept.of Mathematical & Actuarial Sci., Universiti Tunku Abdul Rahman, Malaysia
tancp@utar.edu.my, kuangks@utar.edu.my

The f-divergence of two probability distributions introduced by Csiszar can be used to generate a universal portfolio for investment. There is a convex function f associated with each f-divergence. It is shown that two convex functions generate the same parametric family of universal portfolios if their derivatives have a linear relationship. The alpha divergence is an important family of f-divergences. It is established that the universal portfolio generated by the alpha-divergence is the same as the universal portfolio genereated by the reverse Renyi divergence. An empirical study of the performance of the universal portfolio generated by the alpha-divergence on selected stock-price data sets is presented.

2010 Mathematics Subject Classification: 91B28, 62P05.
Keywords: universal portfolio, f-divergence, alpha-divergence, investment wealth.

P-05. Parameter estimation of quadratics almost demand system of animal protein in Indonesia using generalized method of moments

Fitria Virgantari[1], Hagni Wijayanti[1], Sonny Koeshendrajana[2]
[1]Department of Mathematics, Pakuan University, Indonesia
[2]Ministry of Marine Affairs and Fisheries, Indonesia
fitria.virgantari@unpak.ac.id, hagnizantix@gmail.com, skoeshen@gmail.com

This study aims to apply the General Method of Moments (GMM) estimator to estimate parameter of demand function of animal protein in Indonesia. Demand function to be used is the Quadratic Almost Ideal Demand System (QUAIDS) model. GMM estimator is applied because the parameter of the model is finite-dimensional, whereas the full shape of the distribution function of the data is not be known. Secondary data base on Sicio Economic Survey 2014 in Indonesia carried out by Central Bureau of Statistics were used in this study. Animal protein was grouped in terms of fish, meat, and egg including milk. A rural and urban region categories was added to the model. Result shows that GMM estimator was quite good estimator of the model as shown by coefficient of determination between 51.98% to 69.26%. Six of 9 price variables as well as 4 of 6 income variables (about 67%) are significant. Assumption of model restriction is also satisfied. Economically, the model shows that the share of animal protein consumption is influenced

by its price and household income. The coefficient of region is significant in all type of commodities.

2010 Mathematics Subject Classification: 60K10.
Keywords: QUAIDS model, GMM estimator, demand function, animal protein.

P-06. Zero inflated binomial models for neonatal infant mortality in Indonesia

Wahyu Bodromurti*, Khairil Anwar Notodiputro
Department of Statistics, Bogor Agricultural University
bodro.stk@gmail.com, khairilnotodiputro@gmail.com

We discuss overdispersed Binomial models applied to neonatal infant mortality cases in Indonesia. Overdispersion usually occurs when the data has many zeros, or called as excess zeros. In such case, Binomial models are less fit and the type I error can be inflated or higher false positive rates. This problem can be resolved by using zero inflated Binomial (ZIB) models. Hall (2000) applied ZIB models by modifying the zero inflated Poisson (ZIP) models developed by Lambert (1992). In ZIB models, the response variable is assumed to be distributed as a mixture of Binomial(n, π) and a distribution with point mass of one at zero, with mixing probability p. In this paper, we compared the results of ZIB and Binomial models in modeling infant mortality in the first 28 days of life. The fitness of these models was assessed using ROC curves as well as other criteria such as AIC, AICC, and BIC. The results showed that the ZIB model has better fit when compared to the Binomial model.

2010 Mathematics Subject Classification: 00A71.
Keywords: zero inflated, zero inflated Binomial, excess zero, overdispersion, neonatal, infant mortality.

P-07. Soft set with constraints in decision making problem

Fatia Fatimah[1], Dedi Rosadi*[1], RB. Fajriya Hakim[2]
[1]Department of Mathematics, Universitas Gadjah Mada
[2]Department of Statistics, Universitas Islam Indonesia
fatia@ut.ac.id, dedirosadi@gadjahmada.edu, hakim@fmipa.uii.ac.id

Soft set theory emphasizes that its solution is free from constraints. In daily life, parameters and constraints required in decision-making problems. This is because humans have limitations. This paper initiate the novel concept called soft set with constraints. We define the basic properties of operations on this concept such as complement, AND, OR operator, union and intersection. Finally, an application of soft set with constraints in decision making problem is also discussed.

2010 Mathematics Subject Classification: 62C86.
Keywords: soft set, constraint, decision making.

P-08. Forecasting of wind speed in Yogyakarta using radial basis function network based state dependent autoregressive

Herni Utami
Department of Mathematics, Universitas Gadjah Mada
herni_utami@ugm.ac.id

In this paper, we present a model for forecasting of wind speed in Yogyakarta using radial basis function network based state dependent autoregressive. The model can capture nonlinear factor in a data and give good accuracy. To estimate the model, an attempt is made to approximate the statedependent parameter by employing the Gaussian radial basis function. The model is optimized by algorithm structured nonlinear parameter optimization method that divide the model parameters into linear and nonlinear parameters. We will apply the model predict wind speed in Yogyakarta.

2010 Mathematics Subject Classification: 60G25.
Keywords: radial basis function, wind speed, autoregressive, forecasting.

P-09. Analysis of variables affecting unemployment rate and detecting for cluster in Java island in 2015 to 2018

Yekti Widyaningsih, Didi Harlianto, Putra A. Samuel
Universitas Indonesia
yekti@sci.ui.ac.id, didi.harlianto@sci.ui.ac.id, putra.a@sci.ui.ac.id

The main objective of this study was modeling the Unemployment Rate (UR) in Java Island, with rate of disease, infant mortality rate, educational level, population size, proportion of married people, technological literacy, and government policy as the explanatory variables. Spatial factors were also considered in the modeling since the closer the distance, the higher the correlation. This study would also predict the UR in the future to see whether the UR was tend to be better or worse. The modeling would be done for all six provinces and each provinces, to see whether there was a different result or not. This study used the secondary data from BPS (Badan Pusat Statistik). The data would be analyzed using Moran I test, to obtain the information about spatial dependence, using Spatial Autoregressive modeling to obtain the information, which variables were significant affecting UR and how great the influence of the spatial factors, and using Space-Time Autoregressive Moving Average (STARIMA) to predict the UR in the future. The results were, variables proportion of married people, rate of disease, and population size were related significantly to UR when the modelling was done for all six provinces and the UR tend to become greater in the next three years. In all six provinces, the Hotspot of unemployed would also be detected districts/cities using Spatial Scan Statistics Method. The results were 22 districts/cities as a regional group with the highest unemployed (Most likely cluster) in the study area; 2 district in Banten, 2

districts/cities in West Java, 1 district/city in Central Java, 15 districts/cities in East Java are a regional group with the highest unemployed in Java Island.

2010 Mathematics Subject Classification: 37A50.
Keywords: unemployment rate, Moran I Test, spatial auto regressive, STARIMA.

P-10. Modified HAM for solving a class of nonlinear Volterra-Fredholm Integro-difierential equations

M. Kammuji[1], Z. K. Eshkuvatov[2,3], Arif A. M. Yunus[1]
[1]Faculty of Science and Technology, Universiti Sains Islam Malaysia (USIM)
[2]Faculty of Science and Technology, Universiti Sains Islam Malaysia(USIM)
[3]Institute for Mathematical Research, Universiti Putra Malaysia (UPM)
sam long91@yahoo.com, arifasraf@usim.edu.my, zainidin@usim.edu.my

In this note, modified homotopy analysis method (HAM) together with Gauss-Legendre quadrature formula (GLQF) are used to solve semi analytical solution of a class of nonlinear Fredholm-Volterra Integro-Differential Equations (NFVIDEs) of order "2". Mixed boundary conditions are imposed and initial guess is chosen as a function satisfying boundary conditions. Existence of the inverse of higher order differential operator reduces problem into convenient form and the use of Adomian polynomials for nonlinear terms together with GLQF provides efficient algorithm for mixed boundary value problems. Existence and uniqueness of the solution of the integro-differential equation is obtained. Finally, illustrative examples are shown to validate the proposed method.

2010 Mathematics Subject Classification: 45J05, 45L05.
Keywords: HAM, quadrature formula, nonlinear terms, approximate solution, boundary conditions.

P-11. A statistical analysis on estimating the exchange rate of the Philippines

Jackie D. Urrutia[1], Razzcelle L. Tampis[2]
[1]Polytechnic University of the Philippines - Sta. Mesa Campus
[2]Polytechnic University of the Philippines-Parañaque Campus
jdurrutia@pup.edu.ph, jackieurrutia20@gmail.com, math urrutia@yahoo.com.ph
razzcelletampis@gmail.com

Exchange rate serves as the basic link between the local and the foreign markets for several products, services, and financial assets. Movements in the exchange rate can disturb domestic prices of imported goods and services, the cost of servicing on foreign debt, and the countrys external sector through its impact on foreign trade. This study aims to forecast the Exchange Rate (y) of the Philippines for the next five years starting from 2016 to 2020, and determine which among the determinants: Inflation Rate (x_1); Purchasing Power of Peso (x_2); Interest Rate (x_3); Exports (x_4); Imports (x_5); and Balance of Payments (x_6), is a significant factor that can influence Exchange Rate. The researchers used the monthly data of

the variables starting from January 1999 to December 2015, which were gathered from Bangko Sentral ng Pilipinas with a total of 204 observations. In forecasting the dependent variable, the researchers used the BoxJenkins Methodology. The researchers also examined the granger causal relationship between the variables using the Pairwise Granger Causality Test. Johansen Cointegration Test was also used to check if there exist cointegration among the variables. Stepwise Multiple Linear Regression was performed to determine the significant factors that can actually predict the Exchange Rate. This paper will help the government in monitoring the Exchange Rate, and implementing measures to maintain the order and stability in the foreign exchange market.

2010 Mathematics Subject Classification: 62B15.
Keywords: Box-Jenkins methodology, exchange rate, Johansen cointegration test, pairwise Granger causality test, stepwise multiple linear regression.

P-12. Forecasting on the number of elderly people using ARIMA method

Hery T. Sutanto
Universitas Negeri Surabaya, Indonesia
herytrisutanto@gmail.com

The number of elderly in Indonesia increase significantly. In fact, most of them should be included in government responsibility. By knowing the amount of elderly in the future, the government could anticipated on how they design the policy. This paper is aimed to estimate the number of elderly people using Autoregressive Integrated Moving Average (ARIMA) method. This method generalized the data in the upcoming 2 years using the recent data of population. The ARIMA method make the noise in the forecasting almost insignificant.

2010 Mathematics Subject Classification: 62-07.
Keywords: forecasting, ARIMA method, elderly people.

P-13. Pricing of unit-linked life insurance contract with an asset value guarantee under the variance gamma process

Ferry Jaya Permana*, Dharma Lesmono, Erwinna Chendra
Department of Mathematics, Universitas Katolik Parahyangan, Indonesia
ferryjp@unpar.ac.id

The unit-linked life insurance contract with an asset value guarantee provides a minimum benefit or asset value guarantee, payable on death or maturity date, depending on the type of life insurance. As opposed to the traditional of life insurance, valuation of this insurance contract involves two uncertainty, those are the mortality and the benefit. Its payable benefit is based on minimum of the price of asset used as the reference asset or a given minimum guaranteed benefit. The existing models are assumed that the price of reference asset follows the geometric

Brownian motion model. Here, the Black-Scholes model will involve in the valuation of the unit-linked life insurance contract. Data of several assets traded in Indonesia market shows that the GBM model is not able to capture the excess kurtosis belonged to the log return of asset. We proposed more realistic model by using the Variance Gamma process to describe the log return of reference asset, then we develop model for pricing such of the unit-Linked life insurance contract. We also apply the proposed model to the asset traded in Indonesia market as the reference asset.

2010 Mathematics Subject Classification: 62P05.
Keywords: variance gamma process, unit-link life insurance, asset value guaranteed.

P-14. Application of spatial scan statistic hotspot detection and ordit ranking on crimes committed by children in a district in Indonesia

Taruga Runadi, Yekti Widyaningsih
Universitas Indonesia
{taruga.runadi, yekti}@sci.ui.ac.id

The rate of crime committed by children plays a role in determining quality of security of an administrative region. The rate of crime committed by children related to some factors, that are public security and order, economy, and social environment so that it can be used as a reference to determine security quality of an administrative region. It is important for the local government to know the worst area in term of crime level. This paper discusses about local security quality that measured by some factors related to criminal activity using ORDIT (Ordering Dually In Triangles) ranking method and hotspot detection using spatial scan statistic. Variables used in this study are number of poor citizen, number of unemployed citizen, number of violence against children case, number of narcotics abuse by children, and number crime committed by children. ORDIT give the result of areas in ranking on criminality level, while the hotspot detection give the hotspot area of a specific cases. The temporary result of this study is that there is compatibility between the result of hotspot detection with spatial scan statistic and regional security quality rank. The worst area is Cinere and the hotspot of crime committed by children is Cinere. Based on the map, this areas are in the north of Depok The benefit of this study is to provide suggestion to local governments related to criminal rank in order to support policy decision making especially for the regions considered to have low quality.

2010 Mathematics Subject Classification: 62H11.
Keywords: spatial scan statistic, ORDIT, criminal, children.

P-15. Scan statistic hotspot detection and ordit ordering based on health multivariable data in Depok

Choirul Basir*, Yekti Widyaningsih
Universitas Indonesia
choirul.basir@sci.ui.ac.id, yekti@sci.ui.ac.id

Health factors and conditions of resident in an area plays an important role to determine the quality of a particular area, as it relates to environmental factors and demography. This paper focuses on the quality of the measured region of several factors using hotspot detection method and ORDIT Ordering (Ordering Dually In Triangles). The factors are the number of infant and child death, infant with low birth weight, children malnourished, maternal death, births without the help of health professionals, outpatient visits, hospitalization visits. The expected outcome of this study is the appropriate between the results of hotspot detection and the severity areas ranking. The result of Scan Statistics Hotspot Detection using SaTScan and Ordit Ranking using R showed that the health center most in need of service improvement is UPT Pancoran Mas health center in Pancoran Mas district, Depok City. The benefits of this research is to inform the local governments about the most severe area based on those factors. So that the local governments can adopt policies to improve those areas.

2010 Mathematics Subject Classification: 62H11.
Keywords: scan statistic, ORDIT, hotspot detection, health multivariable.

P-16. Elucidation of jamu working mechanism based on network of active compound-target protein-gene ontology

Vitri Aprilla H*, Farit Mochamad Afendi, Wisnu Ananta Kusuma
Bogor Agricultural University
vitriaprilla10@gmail.com, fmafendi@ipb.ac.id, w.ananta.kusuma@gmail.com

Plant medicine is a type of plant that can be used to solve various problems in the human body either due to illness or other disorders. Jamu is an herb that manufacture materials taken from several parts of medicinal plants containing substances and compounds important and beneficial for the body. So far, the efficacy of most jamu is proven empirically in this analysis, to fill this gap we intend to elucidate the working mechanism of jamu using computational approach. The jamu is designed for Type 2 Diabetes (T2D) and consist of four plants, namely: Ginger (Zingiber officinale), Brotowali (Tinospora crispa), Sembung (Blumea Balsamivera) and Pare (Momordica charantia). The analysis start with generating the network consist of 3 components: (1) plant's active ingredients (obtained from Knapsack and DNP Database; consists of 58 metabolites), (2) ingredients (take from Pubchem database; consist of 413 proteins), and (3) gene ontology of the proteins (generated from DAVID database; consist of 3104 GO terms). Next, we

implement clustering of those components using concept of tri-partite graphs. Tri-partite graph is used to classify the constituent components of a network of four plants above, in order to obtain system constituent parts of herbs. It will be easier to reveal the mechanism of action of jamu.

2010 Mathematics Subject Classification: 03B48.
Keywords: jamu, GO, DAVID, tri-partite graph.

P-17. Generalized space time autoregressive with Exogeneous variable model and its application

Dewi Astuti[1], Soemartini[2], Budi Nurani Ruchjana[*3]
[1]Center of Statistics, Bureau of West Sumatera, Indonesia
[2]Department of Statistics, Universitas Padjadjaran, Indonesia
[3]Department of Mathematics, Universitas Padjadjaran, Indonesia
dewiastuti@bps.go.id, tine_soemartini@yahoo.com, bnurani@gmail.com

In this paper we propose the Generalized Space Time Autoregressive with variable Exogeneous, abbreviated GSTARX as GSTAR development with the addition of exogenous variables. GSTARX not only involves the element of time and location, but also the influence of exogenous variables in the model. GSTARX equation can be written as a linear model, so we can estimate model parameters GSTARX using Ordinary Least Squares (OLS) method. For our case study using GSTARX model with uniform and inverse distance weights to predict Crude Palm Oil (CPO) exports in several locations on the island of Sumatera, where X is the international CPO prices.

2010 Mathematics Subject Classification: 62M10, 63M30, 62H11
Keywords: GSTARX, uniform weight, inverse distance, OLS, CPO.

P-18. The economic impact of priority economic sector in Central Java Province: an analysis of social accounting matrix

Sri Subanti[1], Inaki Maulida Hakim[2], Arif Rahman Hakim[*3]
[1]Department of Statistics, Sebelas Maret University (UNS)
[2]Department of Industrial Engineering, University of Indonesia (UI)
[3]Fac.of Eco.& Business, UI and Inst.for Research & Social Services, UNS
sri_subanti@yahoo.com, inakimaulida.hakim@gmail.com, arhaqkm@gmail.com

This paper is focused on priority economic sector and the social accounting matrix analysis. There are two ways to calculate priority economic sector, (1) to compare share of economic sector i with total output; and (2) location quotient method. From this ways, we can defined the priority economic sector. Then, we use a multiplier analysis for calculation the economic impact of priority economic sector. This study found that, First, poor households income is higher than rich

household income. Second, labor production factor is higher than capital production factor. Our recommendation, priority economic sector can be developed by government of Central Java province.

2010 Mathematics Subject Classification: 40C05.
Keywords: priority economic sector, location quotient, multiplier, social accounting matrix

P-19. Sis epidemic stochastic model for preventing influenza spread with intervention of medical mask and treatment

B. D. Handari*, M. Rohmah, D. Aldila
Department of Mathematics, FMIPA, Universitas Indonesia
{bevina, munzilir.rohmah, aldiladipo}@sci.ui.ac.id

A deterministic model for influenza spread with intervention of medical mask and treatment will be introduce in this article which based from classical SIS epidemic model for constant total human population size. The deterministic model is extended from a deterministic framework to a stochastic model by introducing a random perturbation in success transmission rate parameter, and transform it into a stochastic differential equation (SDE). Conditions of extinction and persistence for the corresponding stochastic related to magnitude of basic reproductive ratio ($\mathfrak{R}_0$) model will be examined. The numerical simulations are generated to support the extinction and persistence conditions. The results will be compared with the corresponding deterministic model.

2010 Mathematics Subject Classification: 34B60, 92D25, 60H10
Keywords: influenza, medical mask, treatment, stochastic differential equation, basic reproductive ratio.

P-20. Jamu informatics: a new perspective in jamu research

Farit Mochamad Afendi*[1], Rudi Heryanto[2], Latifah Kosim Darusman[2]
Nur Hilal A. Syahrir[1], Rizal Bakri[1], Nurul Qomariasih[1], Shigehiko Kanaya[3]
[1]Department of Statistics, Bogor Agricultural University, Indonesia
[2]Biopharmaca Research University, Bogor Agricultural University, Indonesia
[3]Lab of Computational Systems Biology NAIST
fmafendi@ipb.ac.id, {kemometrik, latifah.kd, nurhilal2502}@gmail.com
rizal.bakri@unm.ac.id, nurulqomariasih@gmail.com, skanaya@gtc.naist.jp

The paradigm of drug development has been shifted from one-drug one-target into multi drug network target. The Indonesian traditional medicines, Jamu, is composed from several plants. It provides a promising source in developing drug addressing this new paradigm. In this paper, we propose a concept of Jamu informatics as a tool in understanding Jamu as well as guidance in developing a new Jamu formula. We provide our implementation of Jamu informatics started from modeling the ingredients of Jamu as to estimating the efficacy of Jamu. We found

that the developed model performs well in predicting Jamu efficacy given the information of its ingredients. Given the model, a new Jamu formula targeted for type-2 diabetes is developed and tested to Zebrafish. The experiment results show that the new Jamu formula is promoting and showing better performance compared to negative control. The ingredient composition of the new Jamu formula is then optimized using the response surface optimization. Finally, we evaluate the working mechanism of the new formula using network pharmacology.

2010 Mathematics Subject Classification: 03B48.
Keywords: jamu, PLS-DA, multiway model, response surface optimization, network pharmacology, synergy effect.

P-21. The application of conjoint analysis with fullprofile design and rating response on Sekolah Tinggi Ilmu Statistik student preference of the lecture quality

Fitri Catur Lestari
Sekolah Tinggi Ilmu Statistik, Indonesia
fitricaturlestari@stis.ac.id

Preferences students on the quality of lecturers from various aspects considered important to be studied specifically. Lecturer with all the characteristics and quality it has a very important role in determining the quality of the university. Measurements can be performed with preference conjoint analysis is an analysis that specifically examines preferences. The design in conjoint analysis used in this research is the design of a complete combination with the kind of response data rating (value). The procedure is multiple linear regression analysis with dummy variables. Sampling method used is purposive sampling method with sample selection was based equalization in segments that allegedly there are different preferences of the students on the quality of lecturers ie GPA, level / grade, high school origin, gender, and economic capacity (income) parents. Based Relative Value Important (NRP), the preference of students to lecturers namely quality control of lectures, self carriage, delivery of content, the ability to motivate students, and learning methods. Preference of students to faculty quality vary depending on the segment level / grade, high school origin, gender, and economic capacity (income) parents. While preference to the quality of the lecturers did not differ by segment GPA.

2010 Mathematics Subject Classification: 62K05.
Keywords: conjoint analysis, preference, complete combination, fullprofile, rating.

P-22. Analysis of hazard rate for proffering claim data in non-life insurance company with Weibull model

Septiani Muchtar*, Nurtiti Sanusi, Andi Kresna Jaya
Department of Mathematics, Hasanuddin University, Indonesia
tyaseptyani@ymail.com, ntitisanusi@gmail.com, andikresna@yahoo.com

Poisson process is a counting process the number of events in the certain time. Process Poisson with constant intensity is called Homogeneous Poisson process, while process Poisson with intensity which is depend on the certain time is called Non Homogeneous Process Poisson (NHPP). As in term on insurance, proffering claim is a randomize event and the number of proffering claim is depend on the time. For modelling this case, data modeled by NHPP with intensity function which is depend on the time. In NHPP there are many model of intensity function with different characteristic. Intensity function is hazard rate from interarrival time. In vehicle insurance has used the increasing function towards the interarrival time, is Weibull model for $\alpha > 1$. Estimation parameter of intensity function Weibull model is using maximum likelihood method which will be countinued with Newton Raphson method. The result of this studies shows that when the interarrival time of claim is become bigger then value of intensity also become big.

2010 Mathematics Subject Classification: 62N01, 62N02, 62F15.
Keywords: process Poisson, non homogeneous process Poisson, intensity function, Hazard rate, Weibull model, maximum Likelihood.

P-23. Theory and application of kubinger test as the equivalent of two-way anova (case study: the effect of reparation method factor and brand factor to the lead level of Chinese medicinal herbs)

Fitri Catur Lestari
Sekolah Tinggi Ilmu Statistik, Indonesia
fitricaturlestari@stis.ac.id

Parametric statistics method can be used if the data fulfill the particular assumptions. If these assumptions can not be fulfilled, the alternative solution is using nonparametric statistics method. Many tests in parametric statistics methods have equivalents or counterparts on nonparametric statistics method. One of tests in parametric statistics method that is usually used in a randomized block design (RBD) and a factorial design (FD) is two-way anova. Two way anova at RBD does not examine the interaction of two factors while one at RF examines it. Two way anova at the RBD has a counterpart in the nonparametric statistics method that is called as Friedman test and two way anova at FD is Kubinger test. Kubinger test formula is derived from the two-way anova test. This research aim are to trace it and apply Kubinger test to pharmacology case study. This research is applied of nonparametric statistics in pharmacy. It wants to know the influence of preparation method factor and brand factor to lead level of Chinese medicinal

herbs. Based on Kubinger test, by a confidence level of 95% and 99% it can be concluded that the interaction between brand factor and preparation method factor to lead level in Chinese medicinal herbs is not significant, the average difference of lead level of Chinese medicinal herbs by brand factor is not significant, and the average difference of lead level of Chinese medicinal herbs by preparation method factor is not significant also.

2010 Mathematics Subject Classification: 62K05.
Keywords: two-way ANOVA, factorial design, Kubinger.

P-24. Spatio temporal model: development and application

Budi Nurani Ruchjana*[1], Stanley P. Dewanto[1], Diah Chaerani[1], Atje Setiawan Abdullah[2], Juli Rejito[2], I Gede Nyoman Mindra Jaya[3], Eddy Hermawan[4]
[1]Department of Mathematics Universitas Padjadjaran-Indonesia
[2]Department of Computer Science Universitas Padjadjaran-Indonesia
[3]Department of Statistics Universitas Padjadjaran-Indonesia
[4]Atmosp.Sci. & Tech. Center of Nat. Inst.of Aero.& Space Bandung-Indonesia
{bnurani, stanleydewanto}@gmail.com, d_chaerani@yahoo.com
{atjesetiawan, jrejito, jay.komang}@gmail.com, eddy_lapan@yahoo.com

In this paper we present the development study of spatio temporal model based on multivariate time series approach and applications on a real phenomena such as environment, the economy, the field of petroleum field, etc. The spatio temporal model based on the analysis of time series multivariate developed in 1975 by Cliff-Ord and then Pfeifer in 1979 with the famous model Space Time Autoregressive (STAR) with the assumption homogeneity of lcharacteristics location. Ruchjana in 2002 extended the STAR to be the Generalized Space Time autoregressive (GSTAR) model in oil field with assumption that the parameters vary per location and provide a stationary condition for GSTAR(1,1) model and using Ordinary Least Squares (OLS) to estimate the parameters GSTAR. Borovkova, Lopuhaa and Ruchjana (2008) prove the properties of consistency and normality assymptotic of OLS estimators of GSTAR.

Furthermore, GSTAR developed by many researchers in Indonesia depends on real phenomenon in daily life become GSTAR-Kriging (2007) by Ruchjana-Darwis for prediction at unobserved locations, GSTAR-ARCH by Nainggolan (2011) and applied for inflation data Western Java, GSTAR SUR (Seemingly Unrelated Regression) by Atiek (2013) assuming no constant variance of the error, and GSTARI by Mulyaningsih (2015) for the price consumer index in Central Java, GSTAR-X by Astuti (2016) with addition of the exogenous variable for Crude Palm Oil Prices on the island of Sumatera, GSTARI-X by Elfiyan (2016) for prediction of active participants of planning family in West Java, GSTARIMAX-SUR by Sjahid (2016) to predict the amount of money at East Java following the GSTARIMAX model of Liu (2010). We also develop clustering GSTAR-Kriging model as a combination

of procedure GSTAR and Kriging methods and apply models for oil production data (2013) and climatic data (2016), particularly for rainfall in West Java.

The history of development model of spatio temporal give the results of research from both theoretical work and also for applications, so we can make a recommendation for the practitioner use the model to predict the time period including the influence of neighboring locations simultaneously, and we use the Mean Absolute Percentage Error (MAPE) for comparing models and to get the best model for forecasting.

2010 Mathematics Subject Classification: 62M10, 63M30, 62H11
Keywords: spatio temporal, GSTAR, GSTAR-Kriging, GSTARIMAX, MAPE, OLS, SUR.

P-25. Application of Cox regression model in analyzing factors that affecting survival rate of tuberculosis patient (case study: Paru Hospital Bogor)

Embay Rohaeti, Ani Andriyati*, Prasetyorini, Esti Oktaviano
Pakuan University, Indonesia
{embayrohaeti, ani.andriyati2}@gmail.com

Survival rate of tuberculosis patients can be affected by many factor such as age, sex, level of education, environment sanitation, smoking habit, and home lighting The factors were classified into two group: internal and external factor. We did survival analysis to tuberculosis patients to know the dominant factors affecting their survival rate. Using Cox regression model, we knew that environment sanitation, smoking habit, and home lighting are affecting their survival rate. We use Weibull distribution with 3 parameters namely $\alpha = 1.36794$, $\beta = 8.48634$, and $\lambda = -0.05489$. From the result, we also know that environment sanitation is the most dominant factor for the survival rate of tuberculosis patients. Hazard value of the patients having bad environment sanitation will increase $e^{1.273}$. Hence the hazard ratio of sanitation is equal to 0.8084, and the risk of patient having bad sanitation is 0.8084 times the risk of patient having good sanitation.

2010 Mathematics Subject Classification: 62N03.
Keywords: tuberculosis, Cox regression, survival analysis, Hazard function, Weibull 3-parameter.

P-26. Classification of customer lifetime value model using Markov chain

Dony Permana*[1], Udjianna S. Pasaribu[2], Sapto Wahyu Indratno[2], Suprayogi[3]
[1]Statistic Study Program, Padang State University, Indonesia
[2]Statistics Research Division, Institut Teknologi Bandung, Indonesia
[3]Industrial System and Techo-Economy, Institut Teknologi Bandung, Indonesia
donypermana27@gmail.com, {udjianna,sapto}@math.itb.ac.id, yogi@mail.ti.itb.ac.id

There are some formulas to calculate customer lifetime value (CLV), a value which describes a potency reward for firm in future time from a customer. One method is using Markov chain stochastic model. Here, a customer is assumed that

has some states which must be endured. If we see how many states of customer and how is the relationships inter states, we can get some Markov models to describe the properties of customers in a firm. As Markov models, CLV define as a vector contains CLV for a customer in every state. In this paper we make a classification of Markov Models to calculate CLV. Start from two states of customer model, we make develop in many states models. But whatever state of customer, its roots are still from two states in the first model. The development a model is based on weaknesses in previous model. Some last models can be expected to describe how real characters of customers in a firm.

2010 Mathematics Subject Classification: 60J20.
Keywords: customer lifetime value, Markov chain, clasification models, customer relationship.

P-27. Stochastic volatility models on Indonesian Rupiah exchange rate returns

Didit B. Nugroho*[1], Tundjung Mahatma*[1], Yulius Pratomo[2]
[1]Department of Mathematics, Satya Wacana Christian University
[2]Department of Economics, Satya Wacana Christian University
{didit.budinugroho, t.mahatma, yulius.pratomo}@staff.uksw.edu

This study aims at assesing the performance of stochastics volatility (SV) models with four different error distributions (normal, student-t, non-central student-t, and generalized hyperbolic skew student-t) and correlated errors for estimating foreign exchange rate returns volatility using daily Bank Indonesia data. The Riemannian Manifold Hamiltonian Monte Carlo algorithm is constructed in the MCMC procedure to estimate model parameters that are unable to be directly sampled. To select a model that best fits the data, the performances of competing models are compared based on the Bayes factor. Our analysis applies daily returns data on eight foreign currency sell exchange rates to Indonesian rupiah (IDR) over the period of January 2010 to December 2015 corresponding to a total of 1474 observations, including the US dollar (USD), the British pound (GBP), the Deutsche mark/euro (EUR), the Swiss franc (CHF), Chinese yuan (CNY), Australian dollar (AUD), Singapore dollar (SGD), and Hongkong dollar (HKD).

The main results of this study are the following: (1) the sampling algorithm works efficiently for the Bayesian inference of the SV models; (2) the 95% highest posterior density interval indicates the presence of a significant correlation between return and volatility for the AUD, SGD, and CHF data; (3) the SV model with the generalized hyperbolic skew student's t-distribution specification for returns error provides the best performance among all candidates in all data.

2010 Mathematics Subject Classification: 65C05.
Keywords: exchange rate returns, generalized student-t, Markov chain Monte Carlo, stochastic volatility.

P-28. Solving credibility using thin plate finite element splines

Windiani Erliana, Agah D. Garnadi, Sri Nurdiati, Gusti Putu Purnaba
Department of Mathematics, Bogor Agricultural University
windi.math@gmail.com

Current formulas in credibility theory often calculate net premium as a weighted sum of the average experience of the policyholder and the average experience of the entire collection of policyholders. Because these formulas are linear, they are easy to use. Another advantage of linear formulas is that the estimate changes a fixed amount per change in claim experience, if an insurer uses which a formal, then the policyholder can predict the change in premium. On the other hand, Venter (1990) points out that in some cases, the loss of accuracy makes a linear formula undesirable. Young (1997) apply decision theory to develop a credibility formula that minimizes a loss function that is linear combination of a squared-error term and a second-derivative term. The squared-term measures the accuracy of the estimator, while the second-derivative term constrains the estimator close to be linear. Young (1997) has completed analytical solution by using Green's function or Sturm's-Liouville eigenvalues/eigenvector. We propose to solve the problem directly the ordinary differential equation using thin-plate finite element splines.

2010 Mathematics Subject Classification: 31B20.
Keywords: boundary value problem, credibility, thin-plate finite element splines.

P-29. Multivariate semiparametric regression

Sri Haryatmi Kartiko[1], Kartiko[2]
[1]FMIPA, Universitas Gadjah Mada, Indonesia
[2]FMIPA, Universitas Sebelas Maret, Indonesia
{s_kartiko, ook_kartiko}@yahoo.com

Nonparametric regression is a form of regression analysis in which the predictor does not assumed to have a certain form but is constructed according to information derived from the data. Nonparametric regression requires larger sample sizes than regression based on parametric models because the data must supply the model structure as well as the model estimates. Kernel function is used to estimate the nonparametric regression. While in parametric regression a certain form has to be assumed. In the case that some independent variables has parametric relation with the response, while the other is not, we will use semiparametric regression. The semiparametric regression has parametric and nonparametric part, which will be estimated simultaneously. This research focus on kernel regression for the nonparametric part, enlarge for more that one regressor which is called multivariate semiparametric regression.

2010 Mathematics Subject Classification: 62G08.
Keywords: parametric regression, nonparametric regression, kernel function.

P-30. Application of poisson-gamma and standardized morbidity ratio (SMR) model in estimating relative risk of vehicle insurance claims

Linda Cyrilla, Farah Kristiani
Department of Mathematics, Parahyangan Catholic University, Indonesia
farah@unpar.ac.id, slindacyrilla@gmail.com

To estimate relative risk of damaged vehicle insurance claims in the future, it needs a calculating process using prior information of the claim amount from past events. This estimation can be done by using Bayesian inference, by modelling prior data into a distribution. One of the conjugacies which is commonly applied in Bayesian approach is Poisson-Gamma. Another method which is usually used to estimate relative risk is Standardized Morbidity Ratio (SMR).

This paper will explain how to estimate relative risk of insurance claims using Poisson-Gamma and SMR model. These models are applied in Bandung municipality, Indonesia, as one of the most populous city. Moreover, relative risk estimations obtained are mapped on Bandung map. From the application of both models, it can be concluded that the estimations using Poisson-Gamma model result in smoother estimations than the ones using SMR model.

2010 Mathematics Subject Classification: 62P05, 62C10.
Keywords: Bayesian, claim, estimation, insurance, Poisson-gamma, relative risk, SMR.

P-31. An application of GSTAR (1,1) model on oil palm data in PT. Perkebunan Nusantara XIII

Dadan Kusnandar, Naomi N. Debataraja
Department of Statistics, Tanjungpura University, Indonesia
dkusnand@untan.ac.id, naominessyana@math.untan.ac.id

This paper investigates the application of space time modeling for forecasting oil palm production. The data used for this study were monthly production of fresh fruit bunches of oil palm from 2005 to 2014. The data were obtained from seven oil palm plantations of PT. Perkebunan Nusantara XIII West Kalimantan. The ordinary least squares methods was applied to estimate the parameters of the model. The GSTAR (1;1) model provided an appropriate model for forecasting oil palm production in PT. Perkebunan Nusantara XIII.

2010 Mathematics Subject Classification: 62-07.
Keywords: spatial data, autoregressive, forecasting

P-32. Simultaneous co-clustering and classification for marketing datasets

Meta Anggistia*, Asep Saefuddin, Bagus Sartono
Department of Statistics, Bogor Agricultural University
meta.anggist@gmail.com, asaefuddin@gmail.com, bagusco@gmail.com

Building predictive model based on heterogeneous dataset may yield many problems, such as less precise in parameter estimation and prediction accuracy. This problem can be solved by segment the data into relatively homogeneous group and then build a predictive model for each group. The advantages for using this strategy are usually results in simpler models, more interpretable and actionable models without any loss in accuracy and reliability in general. This work concern by using dyadic data structure i.e. pair of elements from two different sets such as marketing data set. In marketing data set, the data record a customer behavior across product, beside that the customer and product have their attributes. The proposed method in this work is Simultaneous Co-Clustering and Classification, based on the idea of co-clustering and construction of prediction models using logistic regression to iteratively improve both cluster assignment and fit the model. Although this algorithm converges to a local minimum of a suitable cost function, this algorithm can predict missing data. Since the models have been formed and the customers and products have been grouped, that information can be used for make an effective campaign for business purpose.

2010 Mathematics Subject Classification: 91C20
Keywords: classification, co-clustering, dyadic data

P-33. Application of geostatistics on upperstream Citarum watershed, Indonesia

Windy Setia Ningrum*, Yekti Widyaningsih, Tito Latif Indra
Universitas Indonesia
{win.dy, yekti, tito.latif}@sci.ui.ac.id

In the recent years, the condition of watershed in West Java has worsened. The rapid growth of constructions and population make the area around the infiltration of rain water is getting narrow and the river water quality become worse. The objective of this research is to evaluate the Citarum watershed area using Geographically Weighted Regression (GWR) modeling and ORDIT ordering. The observation unit is Third Order area. In GWR modeling, the dependent variable is critical water index, while the independent variables are population density, poverty, and land use. Furthermore, based on these variables, the watershed areas is ranked. Based on the modeling result, the vulnerability of the watershed environment can be predicted, while based on the ordering result the worst and the best areas can be found.

2010 Mathematics Subject Classification: 62H11.
Keywords: spatial, geoinformatics, geographically weighted regression, ORDIT, watershed.

P-34. Space time scan statistic hotspot detection on maternal and infant death in Depok, 2007-2014

Dita Irmayani Siregar*, Yekti Widyaningsih
University of Indonesia
{dita.irmayani51, yekti}@sci.ui.ac.id

The number of maternal and infant deaths are the indicators to asses the health degree of a region. Several studies indicate maternal and infant death in Indonesia is relatively high. This study focuses on maternal and infant deaths, especially in Depok, a district in Indonesia, using space-time scan statistic method. Factors that will be used in this study are the number of maternal deaths during: pregnancy, childbirth, and postpartum; and the number of infant and toddler deaths. The indicators will be considered as classification data.

The unit observation is primary health care area. There are 32 primary health care areas located in 11 sub districts in Depok. The resources of the data is The Department of Health in Depok during period 2007-2014. The objective of this research is to detect the hotspot of maternal and infant deaths cases at a particular time and location. The benefit of this research is to provide the information to the local government about the most severe area on health ministry in Depok.

2016 Mathematics Subject Classification: 03B48.
Keywords: hotspot, space time scan statistic, maternal deaths, infant deaths

P-35. Hotspot detection of malnutrition and pneumonia diseases cases in Depok district using spacetime scan statistic

Miranti Verdiana*, Yekti Widyaningsih
Universitas Indonesia
{mirmiranti59, yekti}@sci.ui.ac.id

There are some problems that affect resident health in Depok district which are the increase number of malnutritions from year to year and the spread of contagious diseases in some places. The objective of this research is to detect the location and time of the hotspot of malnutritions and diseases cases using the Space Time Scan Statistic method. The result of this method shows information about the area and time of hotspot simultaneously. This method detect the hotspot using cylinder shaped scanning window, which is this cylinder is a potential hotspot. The temporary result in this study were found hotspot for malnutrition and the spread of pneumonia in toddlers in the health centers Tapos in Depok District.

2010 Mathematics Subject Classification: 46L53.
Keywords: spacetime scan statistic, hotspot, malnutrition, pneumonia disease.

P-36. Inflation data clustering of some cities in eastern Indonesia

Adi Setiawan*, Bambang Susanto
Satya Wacana Christian University, Indonesia
adi_setia_03@yahoo.com, bsusanto5@gmail.com

In this paper, it is presented how to cluster inflation data of cities in Eastern Indonesia by using the fuzzy c-means method. The points of data will become members of a cluster with probability values in [0,1]. When we apply the method into two clusters, Manado, Gorontalo, Kupang, Merauke and Jayapura tend to become one cluster while other cities, namely Maumere, Ternate, Ambon, Tual, Manokwari, Sorong tend to become members of other cluster. Furthermore, when we apply the method into three clusters, Manado, Gorontalo, Kupang, Merauke and Jayapura tend to become members of first, cluster, Ambon and Tual tend to become members of second cluster, other cities, namely Maumere, Ternate, Ambon, Tual, Manokwari and Sorong tend to become members of third cluster. Similarly, interpretation can be made to the results of applying 6 clusters.

2010 Mathematics Subject Classification: 91C20.
Keywords: fuzzy c-means, clustering, inflation data, eastern Indonesia.

P-37. The approximation of two-dimensional renewal integral equations using mean value theorem for integrals method

Leopoldus Ricky Sasongko[1], Bambang Susanto*[1], Sapto Wahyu Indratno[2]
[1]Satya Wacana Christian University, [2]Bandung Institute of Technology
leopoldus.sasongko@staff.uksw.edu, bsusanto5@gmail.com, sapto@math.itb.ac.id

An important aspect in the provision of a two-dimensional warranty is the expected number of product failures during the warranty period. This paper presents a way to obtain the expected number of product failures using the replacement strategy by applying the two-dimensional renewal integral equations. The mean value theorem for integrals method is applied to evaluate the two-dimensional renewal integral equations. The renewal integral equation involves the Weibull Lu-Bhattacharyya bivariate distribution function in a two-dimensional failures model. The bivariate data behavior of the first failures of an automobile component is studied. It turns out that the approximation of the expected number of product failures using the mean value theorem for integrals method is close to that of the Riemann-Stieljies method.

2010 Mathematics Subject Classification: 97I50.
Keywords: two-dimensional warranty, two-dimensional renewal integral equations, mean value theorem for integrals, bivariate distribution function.

P-38. Estimation of truncated spline in nonlinear SEM using weighted least squares method

Ruliana*[1], I Nyoman Budiantara[2], Bambang Widjanarko Otok[2], Wahyu Wibowo[2]
[1]Department of Mathematics, Makassar State University (UNM), Indonesia,
[2]Department of Statistics, Institut Teknologi Sepuluh Nopember (ITS), Indonesia
ruliana.t@gmail.com, {i_nyoman_b, bambang_wo, wahyu_w}@statistika.its.ac.id

Structural equation modeling (SEM) consists of two parts, the measurement model and the structural model. In this paper, we develop a SEM model that the measurement model is linear and the structural model is nonlinear. Structural model explain about relationship between latent variables. Truncated spline is used for modeling the nonlinear relationship between the latent variables. Through weighted least squares (WLS) method, it is found that estimation of parameter truncated spline in nonlinear SEM for two exogen and an endogen latent variables is resulted by optimizing

$$\min_{\gamma} \left\{ \left\| \boldsymbol{\Sigma}^{-1/2} \left(\eta_{\text{skor}} - \mathbf{T}(\omega_{\xi_1}, \omega_{\xi_2}, \kappa_{\mathbf{1}}, \kappa_{\mathbf{2}})\gamma \right) \right\|^2 \right\}$$

and it gave an estimator

$$\hat{\gamma} = \left(\mathbf{T}'(\omega_{\xi_1}, \omega_{\xi_2}, \kappa_{\mathbf{1}}, \kappa_{\mathbf{2}})\boldsymbol{\Sigma}^{-1}\mathbf{T}(\omega_{\xi_1}, \omega_{\xi_2}, \kappa_{\mathbf{1}}, \kappa_{\mathbf{2}})\right)^{-\mathbf{1}}\mathbf{T}'(\omega_{\xi_1}, \omega_{\xi_2}, \kappa_{\mathbf{1}}, \kappa_{\mathbf{2}})\boldsymbol{\Sigma}^{-1}\eta_{skor}$$

The estimator influenced by the location and some knot points $\kappa_{\mathbf{1}}$ and $\kappa_{\mathbf{2}}$.

2010 Mathematics Subject Classification: 41A15, 62G08, 62H86.
Keywords: nonlinear SEM, truncated spline, weighted least squares.

P-39. British put option on stocks under stochastic interest rate

Felipe R. Sumalpong, Jr.*[1], Elvira P. de Lara-Tuprio[2]
[1]MSU - Iligan Institute of Technology, [2]Ateneo de Manila University
felipejr.sumalpong@g.msuiit.edu.ph, edelara-tuprio@ateneo.edu

The British option was first introduced by G. Peskir and F. Samee (2011). In a British option, the holder can enjoy the early exercise feature of American option whereupon his payoff is the 'best prediction' of the European payoff given all the information up to the exercise date under the hypothesis that the true drift of the stock equals a specified contract drift. Consistent with the plane vanilla option, the authors considered a constant interest rate. In this paper, we will consider the pricing of the British put option in a stochastic interest rate environment, particularly the Vasicek model. We will derive a closed form expression for the arbitrage-free price in terms of the rational exercise boundary.

2010 Mathematics Subject Classification: 91G20, 60G40, 35R35.
Keywords: British put option, American put option, European put option, arbitrage- free price, Vasicek model, rational exercise boundary, geometric Brownian motion, optimal stopping time, free boundary problem.

P-40. Stochastic claims reserving: the tweedie's compound Poisson model

Lienda Noviyanti*, Achmad Zanbar Soleh, Gatot R. Setyanto
Statistics Department, Universitas Padjadjaran
{lienda, a.zanbar.soleh, g_riwi}@unpad.ac.id

The problem of how to estimate appropriate incurred but not reported (IBNR) claims reserving has always been among critical problem in general insurance. Estimating of claims reserving is required to increase the optimal service for policyholders. This value should always be available during the period of payment of claims. Its imprecision estimates could destabilize the insurance company. In general, the process of settlement a claim always appear time-lag among claims occurrence, claims reporting and claims payment. Different time-lags formed into the matrix of the Run-off Triangle. Practitioners still perform the chain-ladder method, one of the oldest actuarial literature. This condition is not realistic because the incremental claims X_{ij} (number of reported claims in period j for accident year i) is stochastic. The aim of this study is therefore to use the tweedie's compound poisson model to estimate outstanding IBNR claims reserving. This method also gives the estimated value of which is more suitable for health insurance with a MSEP that is smaller than the chain-ladder method classics.

2010 Mathematics Subject Classification: 62P05.
Keywords: loss reserving, run-off triangle matrix, tweedie's compound Poisson, MSEP.

P-41. Heterogeneity of parameters oil well using Gini index

Atje Setiawan Abdullah[1], Anna Chadidjah*[2], Enny Supartini[2], Emah Suryamah[3]
Iin Irianingsih[3], Kankan Parmikanti[3], Khafsah Joebaedi[3], Budi Nurani Ruchjana[3]
[1]Department of Computer Science, Universitas Padjadjaran, Indonesia
[2]Department of Statistics, Universitas Padjadjaran, Indonesia
[3]Department of Mathematics, Universitas Padjadjaran, Indonesia
{atjesetiawan, annachadidjah}@gmail.com, {arthinii, emah_suryamah}@yahoo.com
iin.irianingsih@gmail.com, parmikanti@yahoo.co.id, {khafsah.jbd, bnurani}@gmail.com

The Gini index is proposed by Corrado Gini as a coefficient expressed in percentage to describe the heterogeneity of variable observation. The Gini coefficient is calculated as a ratio of areas on the Lorenz curve diagram. This ratio is expressed as a percentage or as the numerical equivalent of that percentage, which has value is always a number between 0 and 1. In this paper, we apply the Gini index using R software to describe the heterogeneity of oil well parameters such as permeability, porosity, thickness etc. at volcanic layer Jatibarang. The result of Gini index can be used for taking decision in exploration of oil wells.

2010 Mathematics Subject Classification: 86-08, 86A32.
Keywords: Gini index, oil well, volcanic layer Jatibarang.

P-42. Fitting semivariogram model using linear optimization with R software

Diah Chaerani*[1], Kankan Parmikanti[1], Budi Nurani Ruchjana[1]
Atje Setiawan Abdullah[2]
[1]Department of Mathematics, Universitas Padjadjaran, Indonesia
[2]Department of Computer Science, Universitas Padjadjaran, Indonesia
d_chaerani@yahoo.com, parmikanti@yahoo.co.id, {bnurani, atjesetiawan}@gmail.com

Variogram modeling is one of important stages in geostatistics. Semivariogram is a half of variogram which use for a description of spatial correlation of oil well parameters such as: permeability, porosity, thickness. In this paper, we estimate the semivariogram experimental by least squares method and fitting the best model to theoretical models using an optimization approach to get the minimized objective function. For case study, we use oil well parameters from several oil wells at volcanic layer Jatibarang and R Software for processing data. The result show that using linear optimization, we can get an optimal estimator of experimental semivariogram.

2010 Mathematics Subject Classification: 86A32.
Keywords: semivariogram, optimization, objective function, volcanic layer Jatibarang, R software.

P-43. Structural model to evaluate the effect of participation and satisfaction on ecotourism sustainability

Eka N. Kencana*[1], Tresiani Manutami[2]
[1]Tourism Research Consortium, Udayana University
[2]Department of Mathematics, Udayana University
i.putu.enk@gmail.com, tresianimanutami@yahoo.com

This paper aimed to study the effect of local community participation and visitors' satisfaction on ecotourism sustainability at Badung Regency of Bali, Indonesia. Two aspects regarding ecotourism sustainability had been studied, i.e. (a) economic benefits for local people and (b) tourists' satisfaction. Applying variance-based structural equation modelling, data were collected in July 2015 from local community leaders of Kiadan Village at Badung Regency and tourists visited this village were analyzed. Four latent variables, namely (a) community participation, (b) economic benefits, (c) tourists' satisfaction, and (d) ecotourism sustainability, were used to build structural model. The results showed sustainability of Kiadan's ecotourism was significantly affected by community participation and tourists' satisfaction although community participation's effect slightly greater than tourists' satisfaction with path values for participation and satisfaction as much as 0.641 and 0.633; respectively.

2010 Mathematics Subject Classification: 62H86, 62P25.
Keywords: ecotourism, participation, SEM, sustainability.

P-44. Bootstrap resampling to detect active zone for extreme rainfall in Indonesia

Heri Kuswanto*, Sri Hidayati, Mutiah Salamah, Brodjol S. S. Ulama
Dept.of Statistics, Institut Teknologi Sepuluh Nopember, Indonesia
heri_k@statistika.its.ac.id, sri_hidayati@gmail.com
{mutiah_salamah, brodjol_su}@statistika.its.ac.id

This research aims to apply bootstrap resampling approach to detect active zones related to the extreme rainfall event in one of regions in Indonesia. Active zone is defined as regions or zones on the atmospheric level which have significantly different pattern with other regions prior to the occurrence of extreme event happen in the study area.

The detection will be useful for the forecasters to predict the extreme rainfall events, and hence, the risk of the disaster caused by the events can be minimized. In order to predict the active zone, this paper examines statistical procedure that is able to test the significant difference between weather phenomena at the atmospheric level onset with prior to the occurrence.

2010 Mathematics Subject Classification: 62G32, 62G09, 62G10.
Keywords: bootstrap, extreme, active zone, forecast.

P-45. Calculation of benefit reserves based on true m-thly benefit premiums

Riaman*, Agus Supriatna, Dwi Susanti, Budi Nurani Ruchjana
Department of Mathematics, Universitas Padjadjaran, Indonesia
riaman02@yahoo.co.id, supriatnaagus15@yahoo.com
dwi.susanti@unpad.ac.id, bnurani@gmail.com

Life insurance is a form of insurance that provides reduction in the risk of life or death of a human being. One of the advantages of life insurance customers are insurance companies will give you some money as a backup to the insured if the risk occurs. Insurance reserves an alternative calculation that involves net premiums and costs. Insured may pay an insurance premium series, the publication date of the policy, for the amount to be paid on the death of the insured, or the survival of the insured by the due date. A balance is needed between the obligation of the insured to pay the premium and the insurer as those who manage the assets. Balancing items, on loan, is exceptional principle, the assets and liabilities for the lender to the borrower. In this paper studied the benefits formula reserves in accordance with the formula for net profit monthly premium with a prospective method. This method establishes that the reserves at the end of the first year is zero. Some principles can be used for the calculation of premium benefit, equivalence relations were also discussed.

2010 Mathematics Subject Classification: 62P05, 91B30, 97M30.
Keywords: life insurance, reserves, prospective method, m-thly benefit premiums.

P-46. Forecasting using Hybrid Integer-valued Autoregressive Integrated Moving Average (INARIMA) and Radial Basis Function Neural Network (RBFNN)

Fajarani Juliaristi*, Brodjol S. S. Ulama, Kartika Fithriasari
Statistics Department, Sepuluh Nopember Institute of Technology
fajaranijuliaristi@gmail.com, {brodjol_su, kartika_f}@statistika.its.ac.id

This study aims to forecast the number of dengue fever's case in Surabaya using Hybrid Integer-valued Autoregressive Integrated Moving Average (INARIMA) with Radial Basis Function Neural Network (RBFNN). Hybrid method is a combination of two or more systems in one function is proposed to take advantage of the unique strength of INARIMA and RBFNN models in linear and nonlinear modeling. Let INARIMA model is the linear component, and then the residual from the linear model will contain only the nonlinear relationship. The nonlinear residual value will be analyzed using RBFNN. In INARIMA models, the input is a non negative integer-valued random variable which it is a sequence of independent and identically distributed (IID). In INARMA process, defined Binomial Thinning Operator which is the sum of the Bernoulli random variable. The parameters are unknown at INARIMA models will be estimated using the Conditional Least Square (CLS) Method. The combination of models INARIMA in Hybrid method is RBFNN. RBFNN is a model of the Neural Network (NN) which used to solve nonlinear problems. RBFNN transform the input to nonlinear function using the Gaussian activation function in the hidden layer and then processed linearly in the output layer. In the process of determining the best RBFNN models, used K-means Cluster method to classify the input data into groups or clusters so the number of cluster is equal to the number of neuron in hidden layer.

2010 Mathematics Subject Classification: 62J12.
Keywords: forecasting, INARMA models.

P-47. Testing the predictability of event criticality based on restlessness precedence

Yuyun Hidayat*[1], Titi Purwandari[1], Ismail Bin Mohd[2]
[1]Department of Statistics, Universitas Padjadjaran, Indonesia
[2]Institut Matematik Kejuruteraan, Universiti Malaysia Perlis, Malaysia
yuyunrich@gmail.com, titipurwandari@yahoo.com, ismailmohd@unimap.edu.my

We developed restlessness as input for rice crisis indicator. Significant increase of restlessness in unprecedented is strong indicator for rice crisis. Unprecedented restlessness (UR) focus on precedence analysis in contras with price shock analysis. The objective of the testing is to test whether restlessness precedence can be used to predict crisis / not-crisis events in five year visibility. The forecasting model used in the predictability testing is 9-Year-Period Moving Average (MA9). The

predictability testing is divided into two parts. The first part is the predictability testing for all non-crisis countries and the second part is the predictability testing for all crisis countries. The predictability testing for non-crisis countries is conducted for four forecasting periods, i.e 2004-2008, 2005-2009, 2006-2010, 2007-2011.The predictability testing for all crisis countries can only be conducted for one forecasting period, i.e 2004-2008. This is due to the following considerations: there is only one crisis year, i.e around year 2008, and the crisis should be able to be predicted 5 years before it happens. It can be seen from the testing result of non-crisis countries, MA9 model can predict non-crisis events for 9 of 11 non-crisis countries for all forecasting periods with more than 80% probability. However, the MA9 model is indecisive for Ecuador and Myanmar because there is not any probability of more than 60% for those countries for all forecasting periods.

2010 Mathematics Subject Classification: 62M20.
Keywords: rice crisis, strong indicator, unprecedented restlessnes, predictability.

P-48. Automatic adjustment mechanisms on private pension fund

Joko Purwadi
Dept. of Mathematics, Ahmad Dahlan University, Indonesia
joko@math.uad.ac.id

This paper discussed about how the automatic adjustment mechanism in the pension fund with defined benefits in case conditions beyond assumptions - assumptions that have been determined. Automatic adjustment referred to in this experiment is intended to anticipate changes in economic and demographic conditions. The two method discuss in this paper are indexing life expectancy and indexing of beneficiaries to contributors. In this paper we discussed about how to identify the selection of appropriate Automatic adjustment mechanisms for the private sector pension funds and which mechanisms that hold the better sustainability contribution.

2010 Mathematics Subject Classification: 97K80.
Keywords: automatic adjustment, pension fund, defined benefit.

P-49. Comparative analysis of performance measures of redundant systems under Weibull failure and repair laws

Ashish Barak
Manipal University Jaipur, India
ashishbarak2020@gmail.com

The aim of the present paper is to compare the performance measures of two redundant system under Weibull failure and repair activities using semi-Markov processes and regenerative point technique. Two stochastic models comprises of one original and one duplicate unit are developed with the provision of a single repair facility and priority. All repairs and preventive maintenance, after a pre-specific

time, are perfect. Recurrence relations of availability, mean time to system failure and profit function for both the models are derived. To highlight the importance of the system numerical and graphical results for the difference of both models are obtained with respect to failure rate of original unit.

2010 Mathematics Subject Classification: 97K70.
Keywords: Weibull failure and repair laws, redundant system, preventive maintenance priority, availability.

P-50. New ratio estimators for the finite population mean under SRS and RSS

Monika Saini
Manipal University Jaipur, India
drmnksaini4@gmail.com

This paper proposes ratio estimators for the population mean by using auxiliary information efficiently under simple random sampling (SRS) and rank set sampling (RSS). We obtain the bias and mean square error (MSE) for the proposed estimators and show that the proposed estimator under RSS is more efficient than the estimator under SRS. The results have been illustrated numerically through simulation study.

2010 Mathematics Subject Classification: 97K70.
Keywords: finite population, simple random sampling, rank set sampling ratio estimator, auxiliary variable, study variable, efficiency.

P-51. Exploring the streamflow hydrograph using functional data

Shariffah Suhaila Syed Jamaludin
Universiti Teknologi Malaysia
suhailasj@utm.my

Flood occurrence has become a common phenomenon in a tropical country like Malaysia. Every year during the Northeast Monsoonal Flow starting from November to February, certain region in Peninsular Malaysia particularly at the east coast will encounter this phenomenon. It is considered as an annual natural disaster in the east coast of Peninsular Malaysia. In order to prevent the flood risks and having effective planning and management of water resources, river flows are required to be continuously measured and analysed at a number of stations. Normally, a hydrograph curve is described as a graphical representation of the temporal variation of flow over a period of time. However, the shape of a hydrograph varies in each river basin at each individual storm event. The objective of this study is to propose a functional framework in hydrological application using hydrograph curve as functional data. Daily streamflow series from Sg. Kelantan River Basin is used as the main input in this study. A hydrograph curve built up from this flow series

with respect to time can be considered as a single observation within the functional context. The statistical tools in functional data analysis such as summary statistics of functional data, functional principal component and outlier detection methods are employed in this study. The findings can be concluded such that the method of functional data analysis which treats the whole hydrograph as a function is more representative of the real phenomena and makes better use of available data.

2010 Mathematics Subject Classification: 97K70.

Keywords: streamflow, hydrograph, functional data, sg kelantan river basin, flood, functional principal component, outlier.

P-52. Simulation studies non-trend series fourier estimator on additive multivariable nonparametric regression

I Wayan Sudiarsa*, I Nyoman Budiantara, Suhartono, Santi Wulan Purnami
Departement Statistika FMIPA, Institut Teknologi Sepuluh Nopember (ITS)
wsudiarsa72@yahoo.com

Series Fourier is a good estimator for presumes a periodic regression curve shape. On this paper will be discussed nonparametrik regression model used by using Multivariable non-trend Series fourier estimator on simulation data. Evoking the simulation data by using the program R, making the plot data and determine the optimal k value corresponding by optimum λ. Simulation data with Series Fourier non- trends model and calculate the value of R^2 and MSE. Of the simulation result obtained good model for the simulation data polyomials and exponential functions is Series Fourier non-trend model with $K \geq 2$ and trigonometric functions for the simulation data is Series Fourier non-trend model with$K \geq 4$, with optimal λ value is the approach of the good model.

2010 Mathematics Subject Classification: 62G08.

Keywords: simulation, series fourier, nonparametric regression, additives.

P-53. Spatial extreme value using bayesian hierarchical model for precipitation return levels prediction

Indria Tsani Hazhiah, Sutikno, Dedy Dwi Prastyo
Department of Statistics, Institut Teknologi Sepuluh Nopember
indriatsani@gmail.com, sutikno@statistika.its.ac.id, dedy-dp@statistika.its.ac.id

Extreme precipitation is a rare natural phenomenon categorized as one of extreme climates indicator. It leads to natural disasters such as ?oods and landslides. Prediction of precipitation return level, i.e. quantile which has probability 1/m of being exceeded in m period, become quite important to reduce the negative impact caused by this extreme event. The link between observation recorded on a particular time frame and quantities of longer time scales such as return level is provided by Extreme Value Theory (EVT) commonly used to learn the behaviors of extreme events. Given the observations are recorded from several locations,

the extreme events at di?erent locations are driven by geographical and climatological factors. Unfortunately, the data of these factors are not always available. In this study, the spatial Bayesian hierarchical model (BHM) was employed to update the information in the likelihood that is not fully described by those unobservable covariates. The proposed method was applied to predict the extreme precipitation return level in Ngawi district, East Java, Indonesia. The Peak Over Threshold (POT) scheme was used to obtain extreme observations. The prior distribution was employed to update the likelihood of Generalized Pareto Distribution as an asymptotic distribution of exceedances resulted from POT procedure. The proposed method was expected produce more accurate prediction of precipitation return level in the spatial sense.

2010 Mathematics Subject Classification: 60G70, 62F15, 62H10, 62H11.
Keywords: extreme value theory, peaks over threshold, generalized Pareto distribution, Bayesian hierarchical model, spatial, precipitation, return level.

P-54. Local times for multifractional brownian motion in higher dimensions: a white noise approach

W. Bock[1], J. L. da Silva[2], H. P. Suryawan[3]
[1]Dept. of Mathematics, University of Kaiserslautern, Germany
[2]Centro de Ciências Matemáticas, University of Madeira, Portugal
[3]Dept. of Mathematics, Sanata Dharma University, Indonesia
bock@mathematik.uni-kl.de, luis@uma.pt, herrypribs@usd.ac.id

Multifractional Brownian motion (mBm) is a generalization of fractional Brownian motion to the case where the Hurst parameter is no longer a constant, but a function of the time index of the process. This stochastic process allows us to study in a more realistic way nonstationary continuous Gaussian model with varying pointwise irregularity. In this paper we present the expansion of the local times of mBm in higher dimensions, in terms of Wick powers of white noises (or multiple Wiener integrals). If a suitable number of kernels is subtracted, they exist in the sense of generalized white noise functionals. Moreover, we show the convergence of the regularized truncated local times for mBm in the sense of Hida distributions.

2010 Mathematics Subject Classification: 46F25, 60G22, 60H40.
Keywords: multifractional brownian motion, local times, white noise analysis.

P-55. Optimum test for constant spatial regression using the Cameron-Martin density

Wayan Somayasa, Gusti N. Adhi Wibawa
Mathematic Department of Halu Oleo University
wayan.somayasa@uho.ac.id, adhi-gst@yahoo.com

In this work we consider a signal plus noise process with the noise given by a functional of the set-indexed Brownian sheet. Firstly we derive the Cameron-

Martin density formula for the probability measure of such a process with respect to that of the set-indexed Brownian sheet by applying the analytical approach of Lifshits (2012). It is shown that the density formula involves a Wiener type stochastic integral formula. Next based on this density formula we establish an optimal test for a constant asymptotic spatial regression model by the Neymann-Pearson optimality principle. An exact formula of the critical region of the test is also calculated. The ?nite sample size behavior of the test is investigated by Monte Carlo. At the end of the work we attempt to apply our method to a real data obtained from a mining industry.

2010 Mathematics Subject Classification: 60G15, 60G60, 62G10, 62J05, 62J20.
Keywords: Cameron-Martin density, asymptotic model check, optimum test, Neymann-Pearson test, set-indexed brownian sheet.

P-56. Early detection model of banking crisis in Indonesia based on Bank Deposits Indicator

Sugiyanto*[1], Etik Zukhronah[1], Ihsan Fathoni Amri[2]
[1]Study Program of Statistics, Sebelas Maret University
[2]Study Program of Mathematics, Sebelas Maret University
sugiy50@yahoo.co.id, etikzukhronah@yahoo.co.id, death.bird29@gmail.com

Indonesia has suffered several crises that have occurred since 1970. The crisis is most severe in 1997 that began with the collapse of the Thai Baht currency. The financial crisis is divided into three types: banking crisis, currency crisis and sovereign debt crisis. The banking crisis can be detected by monitoring the banking indicators such as bank deposits, the ratio of loans to savings interest rate, real interest rate spread, and the real interest rate savings. In this study the detection of the banking crisis is based on indicators of bank deposits. This purpose of this study is to determine the appropriate model to detect banking crisis in Indonesia based on bank deposits indicator and then forecast the value of bank deposits to twelve period ahead. In this study used a combination of volatility and Markov switching models assuming two state and three state. The results showed that the data bank deposits with the period from June 1989 to February 2015 is not stationary, have the effect of heteroscedasticity, and switching regime. Therefore the model used to detect the model SWARCH banking crisis. SWARCH model is obtained (2,1) and SWARCH (3,1) can detect the banking crisis in April 1998 and November 1998 to October 2000. Model SWARCH (2,1) and SWARCH (3,1) were used to detect the crisis period March 2015 to February 2016. From detection results in this study obtained that Indonesia will not happen banking crisis in the period March 2015 to February 2016 based on indicators of bank deposits, because the prediction data did not show any structure change and the filtered probabilities value was low.

2010 Mathematics Subject Classification: 62M10, 91B84.
Keywords: banking crisis, bank deposits, early detection.

P-57. Bayesian mixture modeling for blood sugar levels of diabetes mellitus patients (case study in RSUD Saiful Anwar Malang Indonesia)

Ani Budi Astuti[1], Nur Iriawan[2], Laksmi Sasiarini[3]
[1]Department of Mathematics, University of Brawijaya Malang
[2]Statistics Department, Institut Teknologi Sepuluh Nopember, Surabaya
[3]Faculty of Medicine, University of Brawijaya Malang
ani_budi@ub.ac.id, nur_i@statistika.its.ac.id, keenarku@yahoo.com

Bayesian statistics proposes an approach that is very flexible in the number of samples and distribution of data. Bayesian Mixture Model (BMM) is a Bayesian approach for multimodal models with estimation of the model parameters using only one possible model. Diabetes Mellitus (DM) is more commonly known in the Indonesian community as sweet pee. This disease is one type of chronic non-communicable diseases but it is very dangerous to humans because of the effects of other diseases complications caused. WHO reports in 2013 showed the number of DM patients in Indonesia was ranked 7th in the world and DM disease was ranked 6th in the world as the leading causes of human death. In this research will be studied patterns of DM data and will be built the BMM models of the DM data through simulation studies where the simulation data built on cases of blood sugar levels of DM patients in RSUD Saiful Anwar Malang. The results have been successfully demonstrated pattern of distribution of the DM data which has a normal mixture distribution. The BMM models have succeed to accommodate the real condition of the DM data based on the data driven concept. These models have a fairly high accuracy.

2010 Mathematics Subject Classification: 62H10, 97K80.
Keywords: Bayesian approach, mixture modeling, diabetes mellitus, Saiful Anwar Malang.

P-58. Randomness of interest rates in microcredit

Jasmin-Mae B. Santos[1], Marc Diener[2]
[1]Institute of Mathematics, University of the Philippines, Diliman
[2]Laboratoire J.A. Dieudonné, Université de Nice, Sophia Antipolis
jsantos@math.upd.edu.ph, diener@unice.fr

Microcredit is a process that allows efficient lending without collateral. It's characterized by a large number of frequent settlements with possible delay in repayment, creating randomness of the actual interest rate. We take the example of Yunus equation to examine the probabilistic law of this rate, as a measure of risk in microcredit. In particular, we aim to study the case where a borrower has a single random delay in repayment and come up with an asymptotic expansion of the rate involved.

2010 Mathematics Subject Classification: 91G40, 91G6.
Keywords: microcredit, random interest rate, Yunus Equation, asymptotic expansion.

P-59. Learning Poisson distribution through experiencing real life activities: interarrival times data collection

Baiq Rika Ayu Febrilia*, Indira Puteri Kinasih
IKIP Mataram, Indonesia
rika.febrilia@gmail.com, indiraputeri@gmail.com

This paper describes the Poisson distribution learning process through real life data collection activities. Based on the results of the interview a few students, they tend to believe that the course Mathematical Statistics I hard, is too theoretical and not relevant to their everyday lives. We tried to design a Poisson distribution of learning activities through real life data collection activities to assist in teaching the Poisson distribution significantly. This research was conducted in five students majoring in mathematics education. Students are asked to conduct a survey of visitors at several educational centers and shopping areas. We guide students to process the data using Poisson distribution. The results were obtained through observation sheets and interviews of students involved to investigate the response and the impact of this learning directly. This activity provides a new perspective for students. They are able to apply the Poisson distribution on the real problems and make this experience as a foundation to be young researchers through the material they learned in class.

2010 Mathematics Subject Classification: 62H10.
Keywords: learning process, Poisson distribution, real life problem.

P-60. K-means and GIS for mapping natural disaster prone areas in Sumatera and Kalimantan islands

Suwardi Annas*, Zulkifli Rais
Department of Statistics, Makassar State University, Makassar, Indonesia
Suwardi_Annas@yahoo.com, zhoelbrowho@gmail.com

This study proposes a joint k-means and Geographical Information System (GIS) method for mapping natural disaster prone areas. Types of natural disasters that are used as variables, namely landslides, floods, floods with materials, earthquakes, tsunami, tide, tornado, mountain erupts, forest fire and dryness. Data obtained from a total of 191 districts in Sumatera and Kalimantan islands, Indonesia. The k-means method have mapped the areas of natural disaster into 3, 4, 5, and 6 of clusters. This result showed that the best cluster resulted by 6 of cluster with the smallest root mean square standard deviation (RMSD) than other clusters. Although k-means has obtained the best cluster, however, it was difficult to reveal the clustering of natural disaster districts in the two-dimensional map. Under this circumstances, a GIS method was used to improve the cluster visualization of k means. The main purpose of GIS is to develop a visual map of the natural disaster districts according to a given cluster of the k-means. GIS gave highly visualization information of district clusters, which shows that this method

can be a useful tool to improve the result of k means clustering. A joint of the proposed methods is a reliable means for clustering and visualizing the data, and enables interpretation of the disparities of natural disaster by districts in Sumatera and Kalimantan islands.

2010 Mathematics Subject Classification: 05D40.
Keywords:: GIS, k-means, natural disaster, RMSD.

P-61. Statistical ARIMA model: development and application in LAPAN

Eddy Hermawan*[1], Budi N. Ruchjana[2], Atje S. Abdullah[3] I Gede N. M. Jaya[4]
Sinta Berliana Sipayung[1], Shailla Rustiana[5], Krismianto[1]
[1]Atmospheric Science and Technology Center of LAPAN Bandung, Indonesia
[2]Department of Mathematics Universitas Padjadjaran, Indonesia
[3]Department of Computer Science Universitas Padjadjaran, Indonesia
[4]Department of Statistics Universitas Padjadjaran, Indonesia
[5]Geophysic and Meteorology Department of IPB, Indonesia
eddy_lapan@yahoo.com, bnurani@gmail.com, atjesetiawan@gmail.com, jay.komang@gmail.com, s_berlianasipayung@yahoo.com, shailla.rustiana@yahoo.com, krismianto.lapan@gmail.com

In this present study, we mainly concerned to review the general information of development of climate modeling at LAPAN. Currently, LAPAN has both dynamic and statistical climate models. The dynamic climate model based on global circulation models and limited area models. While, the statistical models based on ARIMA models, canonical and wavelets. Climate models are derived from the CSIRO, Australia. Global circulation models currently owned by LAPAN has a horizontal resolution of 500 x 300 km which can be used to perform simulations, predictions and scenarios of climate variability and change mainly due to the raising rate of carbon dioxide (CO2) emissions. To use the global circulation model locally with a high degree of accuracy required better spatial resolution. Thus it needs further study using in-situ data for calibration and confirmation of the model performed. Meanwhile, the limited area model has a horizontal resolution of about 30 x 30 km is still in early stages of assessment, and its application is still limited to the simulation of climate variability in Indonesia. To support the computational modeling of the climate, at this time LAPAN utilize high performance computing systems with multiprocessor machine that we call as the PC Clusters with 40 node, a number of other high-performance workstations. Parallel programming for multiprocessor was developed for running the global circulation models and regionally also. Some preliminary results of this present study, especially using the statistical model (ARIMA) and the utilization of downscaling technique for better understanding of climate variability study over Indonesia will be presented in this important meeting.

2010 Mathematics Subject Classification: 37M10, 62M10
Keywords: GCM, LAM, ARIMA.

P-62. VARX and neural network models for forecasting train passenger data with calendar variation effect

Lusi Indah Safitri, Suhartono, Dedy Dwi Prastyo
Department of Statistics, Institut Teknologi Sepuluh Nopember
lusiindah46@gmail.com, {sutikno, dedy-dp}@statistika.its.ac.id

This study aimed to compare the forecasting accuracy between Vector Autoregressive with Exogenous Input (VARX) and Artificial Neural Network (ANN) models. VAR is commonly used to model the linear interdependencies among multiple time series. The VAR equation explains the evolution of each variable on its own lags and the lags of other variables within the model. Other than lags variable, in many applications there exist exogenous variables that affect the series. In such a case, the VAR model with exogenous input so-called VARX model is reasonably employed to solve the problem. The interdependencies among series is not always linear such that VAR model may perform poorly for the data generated from nonlinear process. Artificial neural network (ANN) plays into role when the nonlinear interdependencies arise among the series. The two previously mentioned models were applied to forecast the daily number of passengers of executive class train for Surabaya-Jakarta route departure from Pasar Turi station. The time series plots displayed that there is strong pattern between number of passengers and work-free days time points, i.e. weekend, national free days as well as Eid ul-Fitr and Eid ul-Adha holidays. The calendar variation effect raised by the two holidays along with other work-free days effect are captured in dummy variables considered as exogenous input. The national free days occur at non-regular time points such that they possibly give effect on nonlinearity interdependencies among the series. The best model used for forecasting was selected by means of root mean squared error (RMSE) and Akaike's information criterion (AIC) for out-of-sample data.

2010 Mathematics Subject Classification: 62M10, 62M20, 62M45, 92B20.
Keywords: VARX, neural network, nonlinearity, calendar variation.

P-63. Regional income inequality measurement based on theil index decompotition and weighted variance coeficient

Open Darnius
Universitas Sumatera Utara
open@usu.ac.id

A regional income inequality might be partially caused by the difference of labor force's produtivities. The difference in labor force participants or unemployed rate in any regions can cause the inequality of icome between any regions, eventhough the mean of labor force's productivities are equal. Meanwile the economic growth can be divided into three main sectors i.e. primary, secondary and tertiary sectors, consequently a new measurements of income inequality is neeeded based on these three sectors. The objective of this paper is to develope a new measurement of

regional income inequality using the theil index decompotition and a weighted variance coeficents in account of three main sectors of economic growth.

2010 Mathematics Subject Classification: 62J10.

Keywords: theil index decompotition, income inequality, weighted variance coeficients.

P-64. Hierarchical forecasting of currency inflow and outflow in Bank Indonesia based on hybrid ARIMAX-ANN with GARCH

I Gede Surya Adi Prayoga, Suhartono, Santi Puteri Rahayu
Institut Teknologi Sepuluh Nopember
{igprayoga, gmsuhartono, sprahayu}@gmail.com

Currency inflow and outflow data in Bank Indonesia is a hierarchical time series that has some levels, i.e. branch offices, islands, and national data. In order to manage the currency stock, Bank Indonesia needs the forecast of inflow and outflow for all hierarchical level, so hierarchical forecasting methods are needed. This study concern on forecasting the inflow and outflow by using the best hierarchical method between topdown, bottom-up and optimal combination method. A hierarchical forecasting requires the base forecast of all individual series. In this study, the base forecasts are obtained by using the best model between ARIMAX and hybrid ARIMAX-ANN model. The ARIMAX models are specified by including calendar variation effect of Eid al-Fitr, considering that Indonesia is a country with Muslim majority. This study applies the recent developed ARIMAX model named two level ARIMAX, which can capture the number of days before Eid al-Fitr in corresponding month. The hybrid methodology is implemented in order to increase the accuracy of ARIMAX model. This method utilizes a nonlinear model named artificial neural network (ANN) to model the nonlinear component of data, which cannot be handled by ARIMAX model. All model and method selections are based on the criteria of out-sample root mean squared error (RMSE). This study also examines the presence of heteroscedasticity after the treatment of hybrid modelling and hierarchical forecasting. To model the heteroscedasticity, the generalized autoregressive conditional heteroscedasticity (GARCH) models are applied. Finally, the interval hierarchical forecasts are calculated based on the conditional variance forecasted by GARCH model.

2010 Mathematics Subject Classification: 91B70.

Keywords: hierarchical time series, top-down, bottom-up, optimal combination, ARIMAX, hybrid ARIMAX-ANN, GARCH.

P-65. The ranking of criteria for ship berthing at port dock using fuzzy TOPSIS in different number of experts

Amirah Yaafar[1], Syibrah Naim[1], Lazim Abdullah[1], Ahmad Ayob[2]
[1]School of Informatics and Applied Mathematics, Universiti Malaysia Terengganu
[2]Malaysia 4School of Ocean Engineering, Universiti Malaysia Terengganu
nooramirahyaafar_93@yahoo.com, nurnaim85@gmail.com, {lazim_m, ahmad.faisal}@umt.edu.my

Ports are bound by the need to serve ships and access to navigable water and essentially providers of service activities, in particular for vessels and cargo. The ships may have few options or alternatives to stop by. Thus, selection of suitable port dock is very important to avoid critical issues such as giving rise to environmental pollution and property damage. Recently, Fuzzy Technique for Order Preference by Similarly to Ideal Solution (Fuzzy TOPSIS) is one of the most commonly used approaches in solving numerous multi criteria decision making problems. Initially, the voting method is integrate into the group decision making model to obtain the appropriate attribute weights by aggregating fuzzy linguistic preferences of group of experts. The ranking of criteria for selection of ports dock for berthing in ocean maritime is conducted to illustrate the potentiality reflecting results between two, four and six group of experts. The strength of the proposed work is the ability to deal with uncertainty arising due to lack of real data by different number of experts in judging. Increasing number of experts in ranking the important criteria for selecting port dock exposes different outputs which will be further investigated.

2010 Mathematics Subject Classification: 03B52.
Keywords: Fuzzy TOPSIS, multi-criteria decision making, group of experts, berthing, port dock, ocean maritime.

P-66. The growth curves of Indonesia's education quality using p-splines quantile regression

Yudhie Andriyana, Yadi Supriyadi, Toni Toharudin
Statistics Department, Universitas Padjadjaran
y.andriyana@unpad.ac.id, jadisuprijadi@gmail.com, toni.t0104@gmail.com

National Education Standards are the minimum criteria of the Indonesia's education system. The standard values are always changing from year to year, which can be modeled in a flexible modeling setting. Meanwhile, varying-coefficient models have been developed as an important tool to create a flexible model since the regression coefficients in VCM change smoothly with the values of other variables such as 'time'. On the other hand, quantile regression, as a generalization of median regression, has been widely used in such modeling. The varying-coefficients can be then estimated by minimizing P-splines quantile objective function. In this work, we are interested in applying the method to the national education standard data. Some numerical results together with the detailed procedure will be presented.

2010 Mathematics Subject Classification: 62G08, 62G35, 62G86.
Keywords: quantile regression, varying-coefficient models, P-splines, National Education Standards.

P-67. Multilevel structural equation modeling: analysis of weighted least square method on non-normal observed variables

Yudhie Andriyana, Yadi Supriyadi, Toni Toharudin
Statistics Department, Universitas Padjadjaran
y.andriyana@unpad.ac.id, {jadisuprijadi, toni.t0104}@gmail.com

Structural Equation Modeling is used to show how the relationship between latent variable and observed variable, however, it tends to be less focused on structural and hierarchical data. On the other hand, multilevel modeling is used when the structure of the data are in the hierarchical form, however, it has a limitation, that it often fails to have direct modulation result under complex causal process. Some studies synthesized both models and enhance them as Multilevel Structural Equation Modeling (ML-SEM). Multilevel Structural Equation Modeling (ML-SEM) is employed using non-normal observed variable and will be estimated under Weighted Least Square (WLS), because it does not depend on form of distributed data. It means Weighted Least Square (WLS) method accepting non-normality. In this study, Multilevel Structural Equation Modeling is applied on Maternal Health Care (MHC) sample (n=8933) using Survey Demografi Kesehatan Indonesia (SDKI) 2012 data. The objective is to know the variance of SDKI in the both of individual and province level using dichotomous categorical indicators.The result shows variance in the both of individual and province level under its indicators from SDKI and Delivery Care (DC) factors. On the other hand, invariance is generated in the both of individual and province level from Post Natal Care (PNC) factors.

2010 Mathematics Subject Classification: 91B70.
Keywords: structural equation modeling (SEM), multilevel model, weighted least square, Limited Information Estimation, dichotomous, SDKI 2012.

P-68. Selection of basic model for Black-Litterman portfolio

Retno Subekti, Sara Khairunnisa
Yogyakarta State University
retnosubekti@uny.ac.id, khairunnisasara@gmail.com

The basic model of portfolio strategy by using Black Litterman is the CAPM. As the basis of a model that is still growing, some researchers try to apply another strategy to be combined with views to form some other portfolios while using basic Black Litterman as a reference portfolio formation. In this study, some of the development model and the original version of Black Litterman presented with empirical studies conducted on the Indonesian stock market.

2010 Mathematics Subject Classification: 91G10.
Keywords: basic model, Black Litterman, strategy.

P-69. Using lattice methods to solve real-options valuation problems with learning options and changing volatility

F. Werry, K. A. Sidarto
Industrial and Financial Mathematics Research Group, ITB
werry.febrianti@gmail.com, sidarto@math.itb.ac.id

Real options are related to investment in long term. Investment in the long term causes uncertainty in real asset price and management flexibility. Since real options have some similarity with financial options so that some solution methods in financial options especially lattice methods may be used to real options problems. Adding learning options as a feature of real options implies modification of the lattice methods. At the beginning of collecting information, the uncertainty of the project value is commonly high. The uncertainty of the project value is related to the projects volatility so that when the uncertainty of the project value is high then the projects volatility is also high. Since there is possibility to collect information through learning options, it will reduce the uncertainty of the project value and so does the projects volatility. The changing volatility in binomial lattice is constructed by using different length of time steps during investment period, so the higher volatility is, the shorter the length of time steps is. The changing volatility is also modeled in trinomial lattice that contain the learning options. In this case, unlike the standard trinomial lattice, the probability of movement projects value will not be constant in each period of investment. An application of the above methods to a problem of real options in the ?eld of petroleum engineering is also given.

2010 Mathematics Subject Classification: 97M30.
Keywords: changing volatility, lattice methods, learning options, real options.

P-70. Evaluating fuzzy and parametric model for portfolio selection using performance index

Rosita Kusumawati, Retno Subekti
Yogyakarta State University
{rosita_kusumawati, retnosubekti}@uny.ac.id

Problem of portfolio selection can be solved using fuzzy model and parametric models. The evaluation of both models is explained through portfolio performance indices such as the Sharpe, Treynor or Jensen Index using the Indonesian stock market data. Here, portfolio model consider to two point of view, one and two objectives.

2010 Mathematics Subject Classification: 91G10.

Keywords: performance index, portfolio selection, fuzzy model.

P-71. Forecasting stochastic mortality rate and its accuracy

Yusuf H. Kalla, Khreshna I. A. Syuhada
Statistics Research Division, Institut Teknologi Bandung
yusuf_hidayat@s.itb.ac.id, khreshna@math.itb.ac.id

It is widely known that life insurance and annuity products have payoff that depend on (future) mortality rate. Therefore, it is important to forecast mortality rate accurately and develop a good mortality model. In practice, however, there is possible different values between realized and expected mortality rates. This difference leads to potential risk to life insurance company as well as policyholders. It may also affect to various competitive model in pricing and efficiency of the use capital. In this paper, we employ a heteroscedastic model of AR-GARCH. To do this, two methods of parameter estimation, maximum likelihood and quasi maximum likelihood, are carried out. Our result shows that AR-GARCH with quasi estimation method provide better forecast.

2010 Mathematics Subject Classification: 97M30.
Keywords: ARCH, life insurance, mortality table, quasi-ML.

P-72. Comparison in feature selection techniques based on wrappers and embedded support vector machines for microarray data analysis

Shofi Andari, Santi Purnami
Department of Statistics, Institut Teknologi Sepuluh Nopember Surabaya
shofi.andari@statistika.its.ac.id

Feature selection has become the most interesting challenge in processing the analysis of high-dimensional microarray data. It addresses the issue of dimensionality reduction by obtaining important features to construct a good model for prediction or classification. There are many different feature selection methods have been proposed and developed that are commonly used. Some of these methods are proven to be excellent to boost the accuracy of classification by taking care of redundant and irrelevant instances. The complicated associations among the genes in microarrays data tend to make works more difficult, but removing less important features can improve the accuracy. In this study, we compare between wrappers and embedded techniques for feature selection based on support vector machines. The wrappers techniques were represented by leave-one-out calculation sequential forward selection and the embedded techniques were represented by recursive feature elimination. The experiments are based on high-dimensional microarray datasets and comparing the result with other well-known support vector machines techniques for feature selection.

2010 Mathematics Subject Classification: 62-07.
Keywords: feature selection, support vector machines, microarray.

P-73. Production process quality control of steel pipe coating thickness using u-fuzzy control chart

Diaz Fitra Aksioma, Haryono
Department of Statistics, Institut Teknologi Sepuluh Nopember Surabaya
aksioma_df@yahoo.com, haryono@statistika.its.ac.id, Alfani.husna22@gmail.com

One of the main key to a well-defined industrial and services products is quality. The production process plays an important role to achieve good quality and specifications set by the customer need. Control chart is widely used as one among seven other quality tools to check and to maintain the quality of the production process. One of the most important quality characteristics to be maintained for steel pipe factory is coating thickness. The previous way to control coating thickness quality is only by using specification limit and visual check. This study will take focus on u-fuzzy control chart to maintain the steel pipe coating thickness. the u-fuzzy control chart will be compared to Demerit control chart using Shewart rule. The comparison indicated that u-fuzzy control chart yielded a smoother control line than demerit control chart. Using the best level of accuracy of 0.6, it indicated 6 observations are rather in-control and become an early warning for the factory to upgrade the quality and production process. For demerit control chart, it indicated one observation is out of control limit where the upper control limit is 2.015, the central limit is 0.948 and lower control limit is 0.

2010 Mathematics Subject Classification: 62A86.
Keywords: coating thickness, u-fuzzy, control chart, production process, quality control.

S08. Combinatorics and Graph Theory

Invited Talks

IT-01. Parity of latin squares

Ian Wanless
Monash University, Australia
ian.wanless@monash.edu

A latin square is a matrix in which each row and column is a permutation of the same set of symbols. Finished sudoku puzzles and Cayley tables for finite groups are well-known examples.

Parity is a familiar and important notion in the study of permutations. Latin squares are really just two dimensional permutations and also have a kind of parity. In fact, they have three basic attributes, each of which can be either even or odd. These obey a relationship which means that any two determine the third. So in information theory terms there are really two parity bits (i.e. 4 possible parities). In this talk I will

(a) prove that the possible parities are roughly equally likely when you select a Latin square at random, and

(b) report on our efforts to generalize to a notion of parity for sets of mutually orthogonal Latin squares (MOLS).

This is joint work (a) with Nick Cavenagh and (b) with Sarada Herke, Nevena Francetic and Brendan McKay.

2010 Mathematics Subject Classification: 05B15.
Keywords: parity, latin squares.

IT-02. Chromatic polynomials of hypergraphs: a survey

Fengming Dong*, Ruixue Zhang
Nanyang Technological University, Singapore
fengming.dong@nie.edu.sg, ruixuezhang9@gmail.com

A hypergraph $\mathcal{H}$ consists of an order pair of sets V and $\mathcal{E}$, where V is called *the vertex set* and $\mathcal{E} \subseteq \{e \subseteq V : e \neq \emptyset\}$ is called *the edge set*. If $|e| \leq 2$ for all $e \in \mathcal{E}$, then $\mathcal{H}$ is a graph. For any integer $\lambda \geq 1$, a *proper λ-colouring* of $\mathcal{H}$ is a mapping $\phi : V \to \{1, 2, \cdots, \lambda\}$ such that $|\{\phi(x) : x \in e\}| > 1$ holds for every $e \in \mathcal{E}$. Let $\chi(\mathcal{H}, \lambda)$ be the number of proper λ-colourings of $\mathcal{H}$. As $\chi(\mathcal{H}, \lambda) = 0$ when $\mathcal{H}$ has an edge e with $|e| = 1$, we assume that $|e| \geq 2$ holds for all $e \in \mathcal{E}$. This function $\chi(\mathcal{H}, \lambda)$ is called *the chromatic polynomial* of $\mathcal{H}$, and actually it is indeed a polynomial in λ of degree $|V|$. This talk will review some important results and open problems on $\chi(\mathcal{H}, k)$ and also propose some open problems.

2010 Mathematics Subject Classification: 05C15.
Keywords: graph, hypergraph, chromatic polynomial.

IT-03. Resolvability of vertices in graphs

Hilda Assiyatun
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
hilda@math.itb.ac.id

Let G be a simple connected graph, and $W = \{w_1, w_2, \ldots, w_k\} \subseteq V(G)$ be an ordered set. A code of a vertex $u \in G$, with respect to W, is a $k-$tuple $r_W(u) = (d(u, w_1), d(u, w_2), \ldots, d(u, w_k))$, where $d(u, w_i)$ is the distance between vertices u and w_i. If the codes of any two distinct vertices are also distinct, then W is called a resolving set in G. The minimum cardinality of a resolving set is called the metric dimension of $G, \dim(G)$. This concept was introduced by Slater (1975) (and independently by Harary and Melter (1976)). The parameter of resolvability of vertices in graphs then was extended by Chartrand et al. (2000), using partitions of the vertex set $V(G)$. For an ordered partition $\Pi = \{V_1, V_2, \ldots, V_k\}$ of $V(G)$, a code of a vertex $u \in G$, with respect to Pi, is a $k-$tuple $r_\Pi(u) = (d(u, V_1), d(u, V_2), \ldots, d(u, V_k))$, where $d(u, V_i) = \min\{d(u, v) : v \in V_i\}$. The partition Π is called a *resolving partition* if the codes $r_\Pi(u), u \in V(G)$ are distinct. The minimum k so that there exists a resolving $k-$partition is called the partition dimension of $G, pd(G)$. By adding a restriction to each class V_i, being an independent set, then a resolving $k-$partition induces a proper coloring on vertices of G, using k colors. Chartrand et al. (2002) defined such a partition as a locating $k-$coloring, and the minimum k so that there exists a locating $k-$coloring is called the locating chromatic number of $G, \chi_L(G)$. In this talk we will present the latest results on these three parameters of resolvability of vertices in graphs, in particular the locating chromatic numbers.

2010 Mathematics Subject Classification: 05C12, 05C15, 05C70.

Keywords: metric dimension, partition dimension, locating chromatic number.

IT-04. Euler characteristics in enumerative combinatorics

Masahiko Yoshinaga
Hokkaido University, Japan
yoshinaga@math.sci.hokudai.ac.jp

It is well known that the Euler characteristic can be considered as a generalization of the notion of cardinality of finite sets. More precisely, in 1991, Schanuel made a proposal that the semialgebraic set together with Euler characteristics is one of realizations of "negative sets". In this talk, we look at enumerative combinatorics from Schanuel's veiw points. In particular, we see that several examples of the so-called "combinatorial reciprocity" (cf. Ehrhart reciprocity) holds at the level of Euler characteristics.

This talk is based on the joint work with Takahiro Hasebe.

2010 Mathematics Subject Classification: 06A11, 05A19, 05C31, 14P10.
Keywords: Euler characteristics, semi-algebraic sets, combinatorial reciprocity, posets.

IT-05. Extension of splitting operation from graphs to binary matroids

M. M. Shikare
Department of Mathematics, Savitribai Phule Pune University, Pune (India)
mmshikare@gmail.com

Herbert Fleischner [Eulerian Graphs and Related Topics, Part 1, Vol. 1, North Holland, Amsterdam, 1990] defined the splitting operation on graphs in the following way: Let G be a connected graph and let v be a vertex of degree at least three in G. If $x = vv_1$ and $y = vv_2$ are two edges incident at a vertex v, then splitting away the pair of edges x and y from the vertex v results in a new graph $G_{x,y}$ obtained from G by deleting the edges x and y, and adding a new vertex $v_{x,y}$ adjacent to v_1 and v_2. The transition from G to $G_{x,y}$ is called the splitting operation. Fleischner characterized Eulerian graphs in terms of the splitting operation.

Raghunathan et al. [Discrete Math. 184 (1988) 267-271] extended the notion of splitting operation from graphs to binary matroids as follows: Let M be a binary matroid on a set E and A be a matrix over GF(2) that represents the matroid M. Suppose x and y are in E. Let $A_{x,y}$ be the matrix obtained from A by adjoining the row that is zero everywhere except for entries of 1 in columns labelled by x and y. The the vector matroid of the matrix $A_{x,y}$ is denoted by $M_{x,y}$. The transition from M to $M_{x,y}$ is called a splitting operation on M.

In this talk, we take a review of the several interesting properties of the splitting operation including some of its applications. The circuits, bases, rank function and the coircuits of the matroid $M_{x,y}$ can be characterized in terms of the circuits, bases, rank function and the coircuits of the matroid M, respectively.

The splitting operation on an connected binary matroid may not produce an connected binary matroid. We characterize connected binary matroids which yield connected binary matroids by splitting splitting operation.

The splitting operation on a graphic (resp. cographic) matroid need not yield a graphic (resp. cographic) matroid. We provide a necessary and sufficient condition for a graphic (resp. cographic) matroid to a yield graphic (resp. cographic) matroid by the splitting operation with respect to any pair of elements of the matroid.

2010 Mathematics Subject Classification: 05B35, 05C50, 05C83.
Keywords: Eulerian graph, splitting operation, binary matroid, connectivity.

IT-06. TBA

Manoj Changat
Department of Futures Studies, University of Kerala, India
mchangat@gmail.com

IT-07. A relation between the Tutte polynomial and the HOMFLY polynomial with applications in DNA polyhedra

Xian'an Jin
Xiamen University, China
xajin@xmu.edu.cn

Let G be a plane graph. Let $D(G)$ be the oriented link obtained from G by replacing each edge e of G by an alternatingly oriented 2-tangle T_e. We first establish a relation between the HOMFLY polynomial of $D(G)$ and the edge-weighted Tutte polynomial of G by assigning suitable edge weights which depend on T_e's or equivalently, the chain polynomial of G with labels on edges of G. This relation extends works of F. Jaeger and L. Traldi. Then we apply the relation to DNA polyhedral links, the mathematical model for DNA polyhedra synthesized by chemists and biologists. To deal with complicated double crossover DNA 3-regular polyhedral links, another relation is further established for computing the chain polynomial of the truncated cubic graph with two different labels from the chain polynomial of the original labeled cubic graph by substitutions.

2010 Mathematics Subject Classification: 05C31, 57M27, 92E10.
Keywords: tutte polynomial, HOMFLY polynomial, DNA polyhedra, computations.

IT-08. Hamilton-connectedness in the square of non-separable graphs

Gek Ling Chia[1,2]
[1]Universiti Tunku Abdul Rahman, Malaysia, [2]University of Malaya, Malaysia
chiagl@utar.edu.my, glchia@um.edu.my

The *square* of a graph G is the graph obtained from G by adding edges joining those pairs of vertices whose distance from each other in G is two. A graph G is said to have the $\mathcal{F}_k$ *property* if for any set of k vertices $\{x_1, x_2, \ldots, x_k\}$ in G, there is a Hamilton path from x_1 to x_2 in G^2 containing $k-2$ edges of the form $x_i z_i$, $i = 3, \ldots, k$, which are edges of G. In [Monatsh. Math. 82 (1976) 125–149], it was proved that every 2-connected graph has the $\mathcal{F}_3$ property. In [Discrete Math. 309 (2009) 4608–4613], it was asked whether or not every 2-connected graph has the $\mathcal{F}_4$ property. Recently, with Fleischner, we answer this problem in the affirmative. Also, we show that there exist 2-connected graphs which do not have the $\mathcal{F}_k$ property for any natural number $k \geq 5$.

2010 Mathematics Subject Classification: 05C45, 05C38.
Keywords: square of graph, Hamilton-connectedness, 2-connected graph.

Contributed Talks

CT-01. Generator subgraphs of wheel graphs

Neil M. Mame*[1], Severino V. Gervacio[2]
[1]Batangas State University, Batangas City, Philippines
[2]De La Salle University, Manila, Philippines
mameneil10@yahoo.com, severino.gervacio@dlsu.edu.ph

Graph considered here is finite simple graph, which has neither multiple edges nor loops. Let G be a graph with $E(G) = \{e_1, e_2, \ldots, e_m\}$, for some positive integer m. The edge space of G, denoted by $\mathscr{E}(G)$, is a vector space over the field $\mathbb{Z}_2 = \{0, 1\}$. The elements of $\mathscr{E}(G)$ are all the subsets of $E(G)$. Vector addition is defined as $X + Y = X \,\Delta\, Y$, the symmetric difference of sets X and Y, for $X, Y \in \mathscr{E}(G)$. Scalar multiplication is defined as $1 \cdot X = X$ and $0 \cdot X = \emptyset$ for $X \in \mathscr{E}(G)$. The set $S \subseteq \mathscr{E}(G)$ is called a generating set if every element of $\mathscr{E}(G)$ is a linear combination of the elements of S. For a non-empty set $X \in \mathscr{E}(G)$, the smallest subgraph of G with edge set X is called the edge-induced subgraph of G, which we denote by $G[X]$. Let H be a subgraph of G. The uniform set of H with respect to G, denoted by $E_H(G)$, is the set of all elements of $\mathscr{E}(G)$ that induces a subgraph isomorphic to H. The subspace of $\mathscr{E}(G)$ generated by $E_H(G)$ shall be denoted by $\mathscr{E}_H(G)$. If $E_H(G)$ is a generating set, that is $\mathscr{E}_H(G) = \mathscr{E}(G)$, then H is called a generator subgraph of G. By a wheel of order $n+1$, denoted by W_n, we mean a graph formed by connecting a single vertex, called the hub, to all the vertices of an n cycle. Here,

we consider the wheel W_n where $n \geq 4$ since $W_3 \simeq K_4$ and the generator subgraphs of complete graphs were completely known by Gervacio in 2008. In this paper, we determine all the generator subgraphs of W_n that contain cycles. Moreover, acyclic subgraphs of W_n found to be generator subgraphs were the following: The path P_k if and only if k is even, the disjoint union of paths with odd size and with order at most n, the disjoint union of paths with odd size and with order equal to the order of W_n provided that at least one of its components has order at least 3, and the spider with exactly 3 legs, one leg is of length 1, and its size is odd and at least 5. Finally, necessary conditions for an acyclic generator subgraph of W_n were found. If H is a connected acyclic generator subgraph of W_n, then H is a spider with exactly 3 legs and its size is odd and at least 5 or H is a path with odd size. If H is a disconnected acyclic generator subgraph of W_n, then the size of H is odd and one component of H is a spider with exactly 3 legs whose size is at least 4 and the other components are paths with length at least 1 or H is a disjoint union of paths of order at least 2.

2010 Mathematics Subject Classification: 05C25.
Keywords: edge space, edge-induced subgraph, uniform set, generator subgraph.

CT-02. Hypercubes are determined by their distance spectra

Sakander Hayat*, Jack Koolen, Quaid Iqbal
School of Mathematical Sciences, University of Science and Technology of China
sakander1566@gmail.com, koolen@ustc.edu.cn, quaid.iqbal@yahoo.com

In this talk, we will focus on the following two important problems for the distance matrix of graphs: (1): Spectral characterization, (2): Graphs with few distinct eigenvalues. For (1), we use isometric embedding and metric hierarchy of graphs to prove that the hypercubes have no distance cospectral mates, i.e. they are characterized by their distance spectrum. For (2), we focus on the problem on graphs with three distinct distance eigenvalues. We generalize the results by Lin et al. and prove some new results on this problem.

2010 Mathematics Subject Classification: 05E30, 05C50.
Keywords: cospectral graphs, hypercubes, distance spectra, isometric embedding.

CT-03. A solution of the Erdös - Faber - Lovász conjecture

S. M. Hegde, Suresh Dara
Dept.of Math.& Comp.Sci., National Institute of Technology Karnataka, India
smhegde@nitk.ac.in, suresh.dara@gmail.com

In 1972, Erdös - Faber - Lovász (EFL) conjectured that, if **H** is a linear hypergraph consisting of n edges of cardinality n, then it is possible to color the vertices of **H** with n colors so that no two vertices with the same color are in the same edge. Erdös, in 1975, offered 50 pounds and in 1981, offered 500USD for the proof or disproof of the conjecture. In 1992, Kahn showed that the chromatic

number of **H** is at most $n + o(n)$. In 2008, Sanhez - Arrayo proved the conjecture for dense hypergraphs. In 2010, Faber proved that for fixed degree, there can be only finitely many counterexamples to EFL on this class (both regular and uniform) of hypergraphs. In 1978, Deza, Erdös and Frankl had given an equivalent version of the same for graphs: Let $G = \bigcup_{i=1}^{n} A_i$ denote a graph with n complete graphs $A_1, A_2, \ldots, A_n$, each having exactly n vertices and have the property that every pair of complete graphs has at most one common vertex, then the chromatic number of G is n. The clique degree $d^K(v)$ of a vertex v in G is given by $d^K(v) = |\{A_i : v \in V(A_i), 1 \leq i \leq n\}|$. The maximum clique degree $\Delta^K(G)$ of the graph G is given by $\Delta^K(G) = max_{v \in V(G)} d^K(v)$. If the graph G satisfies the hypothesis of the conjecture, then $\frac{n(n+1)}{2} \leq |G| \leq n^2$. In this paper, we give a coloring of the graph G mentioned above. We construct the graph H_n satisfying the hypothesis of the conjecture with $\frac{n(n+1)}{2}$ vertices and then prove that any graph satisfying the hypothesis of the conjecture can be constructed from H_n. Then using the symmetric latin squares we give a coloring for H_n. Using the coloring of H_n we give for G.

2010 Mathematics Subject Classification: 05C15, 05B15.
Keywords: chromatic number, Erdös - Faber - Lovász conjecture, latin squares.

CT-04. On the computational complexity of Roman domination parameters in graph

Nader Jafari Rad
Department of Mathematics, Shahrood University of Technology, Shahrood, Iran
n.jafarirad@gmail.com

A Roman dominating function (or just RDF) on a graph $G = (V, E)$ is a function $f : V \longrightarrow \{0, 1, 2\}$ satisfying the condition that every vertex u for which $f(u) = 0$ is adjacent to at least one vertex v for which $f(v) = 2$. The weight of an RDF f is the value $f(V(G)) = \sum_{u \in V(G)} f(u)$. An RDF f can be represented as $f = (V_0, V_1, V_2)$, where $V_i = \{v \in V : f(v) = i\}$ for $i = 0, 1, 2$. The Roman domination number, $\gamma_R(G)$, of G is the minimum weight of an RDF on G. Several parameters related to the Roman dominating functions have been considered in the very recent years, for example, Roman bondage number, Roman reinforcement number, total Roman domination number, multiple Roman domination number, paired Roman domination number, and etc. We first establish several bounds for the Roman domination number of a graph under some given properties of the graph. We then determine the computational complexity of several Roman domination parameters, and show that the decision problem for these parameters are NP-complete even when restricted to bipartite graphs or chordal graphs. We also study Roman domination parameters in Random graphs.

2010 Mathematics Subject Classification: 05C69.
Keywords: Roman domination number, Roman bondage number, Roman reinforcement number, complexity.

CT-05. Rainbow 2-connectivity of some classes of Halin graphs

Bety Hayat Susanti*[1,2], A. N. M. Salman[1], Rinovia Simanjuntak[1]
[1]Combinatorial Mathematics Research Group, Institut Teknologi Bandung
[2]Sekolah Tinggi Sandi Negara, Indonesia
bety.hayat{@s.itb.ac.id, @stsn-nci.ac.id}, {msalman, rino}@math.itb.ac.id

A path P in an edge-colored graph G is said to be a rainbow path if no two edges on the path have the same color. For a κ-connected graph G and an integer k with $1 \leq k \leq \kappa$, the rainbow k-connectivity, denoted by $rc_k(G)$, is defined as the minimum integer j for which there exists a j-edge-coloring of G such that every two distinct vertices of G are connected by k internally disjoint rainbow paths. In this paper, we determine the rainbow 2-connectivity of some classes of Halin graphs.

2010 Mathematics Subject Classification: 05C15, 05C40.
Keywords: Halin graph, rainbow 2-connectivity, rainbow path.

CT-06. Dihedral Cayley graph: good drawing and domination number

Maria Linda C. Cabillan, Ia Kristine P. Miranda, Shielden Grail S. Domilies, Bryan Ceasar L. Felipe*, Niño Angelo L. Gaviño, Clarenz B. Magsakay*, Christine Mae R. Penullar, Jomark Francis A. Velasco
Saint Louis University, Baguio City, Philippines
{marialindacabillan, ia_kristine, shieldengraildomilies}@yahoo.com
{yans.epilef, ninz.gavinz}@gmail.com, {clarenzdescartesian, tin_mae, jomarkv08}@yahoo.com

This study looks into the good drawing and domination number of dihedral Cayley graphs. A generalized Cayley table was constructed by having a default system of naming and defining the symmetries of a regular n-gon that constitute the dihedral group D_{2n}. In considering a dihedral Cayley graph, the developed Java program would make use of the order of the dihedral group and the elements of the generating set as inputs to provide the codes for GeoGebra and LINDO that will display a good drawing of the Cayley graph and compute its domination number, respectively.

2010 Mathematics Subject Classification: 97K30, 68R10, 90C10, 90C35
Keywords: Cayley graph, domination number, graph theory, integer programming, good drawing

CT-07. The Ramsey number of a linear forest versus a wheel

Surahmat Supangken*[1], Edy Tri Baskoro[2]
[1]Department of Mathematics Education, Universitas Islam Malang, Indonesia
[2]Combinatorial Mathematics Research Group, Institut Teknologi Bandung
caksurahmat@yahoo.com, ebaskoro@math.itb.ac.id

For given two graphs H_1 and H_2, the *Ramsey number* $R(H_1, H_2)$ is the smallest positive integer n such that for every graph G of order n the following holds: either

G contains H_1 or the complement of G contains H_2. Let F_p be a linear forest, namely a disjoint union of paths with p vertices altogether. In this paper, we study the Ramsey number $R(F_p, W_m)$ where W_m is a wheel of $m+1$ vertices.

2010 Mathematics Subject Classification: 05D10, 05C55.
Keywords: Ramsey numbers, linier forest, wheel

CT-08. The Ramsey numbers for stars of odd order versus a wheel of order nine

Hasmawati
Hasanuddin University of Makassar, Indonesia
hasmaba97@gmail.com

For given graphs G and H, the Ramsey number $R(G, H)$ is the smallest natural number n such that for every graph F of order n: either F contains G or the complement of F contains H. Zhang, Y. et al. showed that for even n and $n \geq 6$, $R(S_n, W_8) = 2n + 2$. In 2010, Ahsan et al. showed that for $n \geq 11$, $n \equiv 3 \pmod 4$, then $2n + 1 \leq R(S_n, W_8) \leq \frac{5(n-1)}{2}$. Recently, we fine that $R(S_{11}, W_8) = 23$, $R(S_{15}, W_8) = 31$, and furthermore we show the exact Ramsey number for $R(S_n, W_8)$, for $n \geq 11$, and $n \equiv 3 \pmod 4$.

2010 Mathematics Subject Classification:05D10, 05C55
Keywords: Ramsey numbers, star, wheel, complement.

CT-09. On size multipartite Ramsey numbers for stars versus paths and cycles

Anie Lusiani*, Edy Tri Baskoro, Suhadi Wido Saputro
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
anielusiani@students.itb.ac.id, {ebaskoro, suhadi}@math.itb.ac.id

Let $K_{l \times t}$ be a complete, balanced, multipartite graph consisting of l partite sets and t vertices in each partite set. For given two graphs G_1 and G_2, and integer $j \geq 2$, the size multipartite Ramsey number $m_j(G_1, G_2)$ is the smallest integer t such that every factorization of the graph $K_{j \times t} := F_1 \oplus F_2$ satisfies the following condition: either F_1 contains G_1 or F_2 contains G_2. In 2007, Syafrizal *et al.* determined the size multipartite Ramsey numbers of paths P_n versus stars, for $n = 2, 3$ only. Furthermore, Surahmat *et al.* (2014) gave the size multipartite Ramsey numbers of paths P_n versus stars, for $n = 4, 5, 6$. In this paper, we investigate the size multipartite Ramsey numbers of paths P_n versus stars, with all $n \geq 2$. Our results complete the previous results given by Syafrizal *et al.* and Surahmat *et al.* We also determine the size multipartite Ramsey numbers $m_j(K_{1,m}, C_n)$ of stars versus cycles, for $n, m \geq 2$ and $j = 2, 3$.

2010 Mathematics Subject Classification: 05D10, 05C55.
Keywords: cycle, path, size multipartite Ramsey number, star.

CT-10. Restricted size Ramsey number for P_3 versus graph of order at most five

Denny Riama Silaban*, Edy Tri Baskoro, Saladin Uttunggadewa
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
denny-rs@students.itb.ac.id, {ebaskoro, s_uttunggadewa}@math.itb.ac.id

Let F, G, and H be simple graphs. The Ramsey number for a pair of graph G and H is the smallest number r such that any red-blue-coloring of edges of K_r contains a red subgraph G or a blue subgraph H. The size Ramsey number for a pair of graph G and H is the smallest number $\hat{r}$ such that there exists a graph F with size $\hat{r}$ satisfying the property that any red-blue-coloring of edges of F contains a red subgraph G or a blue subgraph H. Additionally, if the order of F is $r(G, H)$, then it is called the restricted size Ramsey number. In 1983, Harary and Miller started to find the (restricted) size Ramsey number for any pair of small graphs with order at most four. Faudree and Sheehan (1983) continued Harary and Miller's works and summarized the complete results on the (restricted) size Ramsey number for any pair of small graphs with order at most four. In 1988, Lortz and Mengenser gave both the size Ramsey number and the restricted size Ramsey number for any pair of small forests with order at most five. To continue their works, we investigate the restricted size Ramsey number for a path P_3 versus connected graph of order at most five.

2010 Mathematics Subject Classification: 05C55, 05D10, 05C38.
Keywords: restricted size Ramsey number, path, connected graph.

CT-11. The rainbow vertex connection number of the amalgamation of graphs

Rosmaini*, A. N. M. Salman
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
rosmainiilyas@yahoo.com, msalman@math.itb.ac.id

Let $G = (V(G), E(G))$ be a nontrivial, undirected, and connected graph. For $k \in \mathbb{N}$, a vertex-coloring $c : V(G) \to [1, k]$ is said vertex k-coloring on G. A vertex-colored graph is said rainbow vertex-connected, if any two vertices are connected by a path whose internal vertices have distinct colors. The rainbow vertex-connection number of G, denoted by $rvc\ (G)$, is the smallest number of colors needed to make G rainbow vertex connected. Let m be an integer at least 2 and $\{G_j | j \in [1, m]\}$ be a finite collection of graphs and each G_j has a fixed vertex v_{0j} called a terminal. The amalgamation $Amal(G_j, v_{0j})$ is a graph formed by taking all the G_j's and identifying their terminals. In this paper, we determine the rainbow vertex connection number of amalgamation of some simple graphs i.e gears, fans, and ladders.

2010 Mathematics Subject Classification: 05C15, 05C40.
Keywords: amalgamation, fan, gear, ladder, rainbow vertex connection.

CT-12. Subgroups as dominating sets for a Cayley graph of the dicyclic group

Jose Maria P. Balmaceda*[1], Joris N. Buloron[2], Carmelita M. Loquias[3]
[1]University of the Philippines Diliman
[2]Cebu Normal University, [3]University of San Carlos Cebu
joey@math.upd.edu.ph, {jorisbuloron, lilithloquias}@yahoo.com

A Cayley graph $Cay(G, X)$ of a group G with respect to a subset X of G is a graph with vertex set G and edge set $\{\{x, y\} \mid y = xa \text{ for some } a \in X\}$. If $G = \langle X\rangle, X = X^{-1}$, and X does not contain the identity, the graph $Cay(G, X)$ is simple, undirected and connected. A Cayley graph encodes the algebraic structure of the group. For an arbitrary graph $\Gamma(V, E)$, with vertex set V and edge set E, a dominating set (of vertices) for Γ is a subset D of V such that for every $v \in V\backslash D$ there exists $w \in D$ with $\{v, w\} \in E$. Dominating sets and Cayley graphs are useful in network theory applications. In this paper, we explicitly determine all subgroups of the dicyclic group $Dic_n = \langle a, x : a^{2n} = 1, x^2 = a^n, x^{-1}ax = a^{-1}\rangle$ of order $4n, n > 1$, that form dominating sets for the Cayley graph $Cay(Dic_n, X)$ with respect to a minimal symmetric generating set X. We also present some properties of the group and the corresponding Cayley graph related to domination.

2010 Mathematics Subject Classification: 05C25, 05C69.
Keywords: dicyclic group, Cayley graph, dominating set.

CT-13. On the sum of the Laplacian eigenvalues of a graph

Shariefuddin Pirzada, Hilal Ahmed Ganai
University of Kashmir, India
pirzadasd@kashmiruniversity.ac.in, hilahmad1119kt@gmail.com

Let G be a simple graph with n-vertices, m edges and having Laplacian eigenvalues $\mu_1, \mu_2, \ldots, \mu_{n-1}, \mu_n = 0$. Brouwer conjectured that $S_k(G) \leq m + \binom{k+1}{2}$, for all $k = 1, 2, \ldots, n$, where $S_k(G) = \sum_{i=1}^{k} \mu_i$, is the sum of k largest Laplacian eigenvalues of G. We obtain the upper bounds for $S_k(G)$ in terms of the clique number ω, the vertex covering number τ and the diameter d of a graph G. We show that Brouwer's conjecture holds for certain classes of graphs. The Laplacian energy $LE(G)$ of a graph G is defined as $LE(G) = \sum_{i=1}^{n} |\mu_i - \overline{d}|$, where $\overline{d} = \frac{2m}{n}$ is the average degree of G. We obtain the upper bound for Laplacian energy $LE(G)$ of a graph G in terms of the number of vertices n, the number of edges m, the vertex covering number τ and the clique number ω of the graph.

2010 Mathematics Subject Classification: 15A18, 05B40.
Keywords: Laplacian spectrum, Laplacian energy, clique number, vertex covering number.

CT-14. Restrained-isolate domination in graphs

Benjier H. Arriola
Basilan State College
benj_arriola@yahoo.com

Let G be a simple graph with vertex set $V(G)$ and edge set $E(G)$. A set $S \subseteq V(G)$ is called restrained-isolate dominating set of G if S has an isolated vertex and $V(G) \setminus S$ has no isolated vertex. A restrained-isolate dominating set of minimum cardinality is called restrained-isolate domination number of G, denoted by $\gamma_{r_0}(G)$. In this paper, we obtained the following characterization of the upper and lower bounds of the restrained-isolate domination.

Theorem 1 Let G be a connected graph of order $n \geq 3$. Then $\gamma_{r_0}(G) = 1$ if and only if $\Delta(G) = n - 1$ and $\delta(G) = 2$.

Theorem 2 Let G be a connected graph of order $n \geq 4$ and suppose $\gamma_{r_0}(G) \neq 1$. Then $\gamma_{r_0}(G) = 2$ if and only if there exist two non-adjacent vertices $u, v \in V(G)$ such that $\{u, v\}$ is a dominating set and $deg_G(x) = 2$ for each $x \notin \{u, v\}$.

Theorem 3 Let G be any disconnected graph with isolated vertex of order n. Then $\gamma_{r_0}(G) = n$ if and only if every component of G is a star.

Theorem 4 Let G be a tree of order $n \geq 3$. Then $\gamma_{r_0}(G) = n - 2$ if and only if $\gamma_r(G) = n - 2$.

Theorem 5 Let G be a connected graph of order n containing a cycle. Then $\gamma_{r_0}(G) = n-2$ if and only if G can be obtained from C_3 by attaching zero or more leaves to at most two of the vertices of the cycle.

A realization problem for the existence of the relationship of domination, restrained domination and restrained-isolate domination numbers was also obtained. Other characterization of the restrained-isolate domination in some binary operations were further derived.

2010 Mathematics Subject Classification: 05C69.
Keywords: dominating, isolate dominating, restrained dominating, restrained-isolate dominating, join, corona.

CT-15. Domination in compositions in graphs

Sergio R. Canoy, Jr.*[1], Carmelito E. Go[2]
[1]Dept. of Math. and Stat., MSU-Iligan Institute of Technology, Philippines
[2]Department of Mathematics, Mindanao State University, Philippines
serge_canoy@yahoo.com, lito_go@yahoo.com

Let $G = (V(G), E(G))$ be a graph of order $n = |V(G)|$. The *open neighborhood* of any vertex of v of G is the set $N(v) = \{u \in V(G) : uv \in E(G)\}$, and the *closed neighborhood* is the set $N[v] = N(v) \cup \{v\}$. The open neighborhood of a set $X \subseteq V(G)$ is the set $N(X) = \cup_{v \in X} N_G(v)$, and the closed neighborhood of X is $N[X] = \cup_{v \in X} N_G[v] = N(X) \cup X$. A set $X \subseteq V(G)$ is a *dominating set* of a graph $G = (V(G), E(G))$ if $N[X] = V(G)$. It is a *connected dominating set* of G if it is

a dominating set and the the graph $G[X]$ induced by X is connected. It is a *total dominating set* if $N(X) = V(G)$. The *domination number* $\gamma(G)$ (resp. *connected domination number* $\gamma_c(G)$, and *total domination number* $\gamma_t(G)$) of G equals the the minimum cardinality of a dominating (resp. connected dominating, and total dominating) set of G. One of the most famous unsolved problems in domination theory is Vizing's Conjecture. This conjecture, stated as "*For any graphs G and H, $\gamma(G\Box H) \geq \gamma(G)\gamma(H)$*", where $G\Box H$ denotes the Cartesian product of G and H, motivates the study of domination in different types of graph products as well as the study of different types of domination in various graph products. In this paper we study several types of domination, including the standard domination, total domination, and connected domination in the composition $G[H]$ of graphs G and H. For non-trivial connected graphs G and H, it is shown that $\gamma(G[H]) = \gamma(G)$ if $\gamma(H) = 1$; otherwise, $\gamma(G[H]) = \gamma_t(G)$. On the other hand, $\gamma_t(G[H]) = \gamma_t(G)$. Further, $\gamma_c(G[H]) = 2$ if $\gamma(H) = 1$ and $\gamma_c(G[H]) = \gamma_c(G)$ whenever $\gamma(H) \geq 2$.

2010 Mathematics Subject Classification: 05C69.
Keywords: domination, total domination, connected domination, composition of graphs.

CT-16. Log-concavity, unimodality and monotonicity of s-rook numbers

Richell O. Celeste[1], Roberto B. Corcino[2], Ken Joffaniel M. Gonzales*[1]
[1]University of the Philippines, Diliman, [2]Cebu Normal University
ching@math.upd.edu.ph, rcorcino@yahoo.com, kmgonzales@upd.edu.ph

A sequence $\{a_i\}_{i=0}^n$ is log-concave if $a_i^2 \geq a_{i-1}a_{i+1}$ for all $1 \leq i \leq n-1$ and unimodal if for some j, $a_0 \leq a_1 \leq \ldots \leq a_{j-1} \leq a_j \geq a_{j+1} \geq \ldots \geq a_n$. If $j = 0$ or $j = n$, then the sequence is said to be monotonic. Many sequences in combinatorics such as binomial coefficients and Stirling numbers of the first and second kinds are known to be log-concave and unimodal. In this talk, we give conditions for which the s-rook numbers of Ferrers boards are log-concave, unimodal and monotonic. These numbers are a class of combinatorial sequences introduced by Goldman and Haglund as a generalization of the classical rook numbers. They also appear as coefficients in the normal ordering of words in the language $\{V, U\}^*$ subject to the commutation rule $UV - VU = V^s$. Special attention is given to the s-rook numbers of Laguerre boards and staircase boards, i.e., the normal ordering coefficients of words of the form U^aV^b and $(VU)^n$, respectively. Lastly, we show that log-concavity is preserved when s is reduced or when the board is extended vertically.

2010 Mathematics Subject Classification: 05A19, 11B65, 11B73.
Keywords: rook numbers, normal ordering, log-concavity, unimodality, monotonicity.

CT-17. Graph theory problems arising from angklung performance

Brilly Maxel Salindeho*, Edy Tri Baskoro
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
brilly.maxel@students.itb.ac.id, ebaskoro@math.itb.ac.id

Angklung is a traditional instrument originated from West Java, Indonesia. It is played by shaking and each angklung can only produce one note. A set of angklungs are needed in order to produce a whole song. An angklung player can hold no more than seven angklungs because of the size of the instrument. A player also cannot hold two overlapping angklungs since shaking more than one angklung at the same time is nearly impossible. These restrictions create problems that can be modeled as mathematical problems. One of them is called the angklung distribution, which is the problem of how to distribute angklungs to each player so that no player holds two or more overlapping angklungs with the least possible number of players. Another problem is known as angklung switching, which is about how to minimize the number of changes in the angklung distribution in order to play a set of songs. In this paper, we model these two problems into graph theoretical problems. We use the concept of coloring and matching to solve these problems.

2010 Mathematics Subject Classification: 05C15, 05C70.
Keywords: angklung, coloring, distribution, graph, matching.

CT-18. The rainbow 3-connection number of the cartesian product of a path and certain graphs

M. A. Shulhany*, A. N. M. Salman
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
ahmad.shulhany@yahoo.com, msalman@math.itb.ac.id

Let $G = (V(G), E(G))$ be a nontrivial, 3-connected, finite, and undirected graph. Let $k \in \mathbb{N}$, an edge k-coloring $c : E(G) \to [1, k]$ is called k-coloring on G. A $u - v$ path in edge-colored G is said rainbow path, if its edges have different colors. Meanwhile, G is said rainbow 3-connectivity, if every two different vertices of G are connected by three internally disjoint rainbow paths. The rainbow 3-connection number of G, denoted by $rc_3(G)$, is the smallest number of colors needed in order to make G rainbow 3-connectivity. In this paper, we consider the Cartesian product of a path P_n and another graph G. We derive an upper bound of the rainbow 3-connection number of $P_n \square G$, where G is any 3-connected graph. Besides that we determine the rainbow 3-connection number of the Cartesian product of a path and a complete, a path and a cycle, and a path and a wheel.

2010 Mathematics Subject Classification: 05C12, 05C15, 05C38, 05C40, 05C76.
Keywords: cartesian product, complete, cycle, path, rainbow 3-connection number, wheel.

CT-19. Hypermatrices and hypergraphs

Daniel Allan Juvito
Institut Teknologi Bandung, Indonesia
daniel.juvito@students.itb.ac.id

Hypergraph is a generalization of the graph, that is one edge of the hypergraph can connect more than two vertices. Coloring on hypergraph is defined as the color on each vertex of the hypergraph such that there are at least two different colors in one edge. While the chromatic numbers on hypergraph is the minimum number of colors to color the hypergraph. Uniform hypergraph is a hypergraph that each edge connecting the vertices by the same amount. Adjacency of uniform hypergraph can be encoded into hypermatrix. Hypermatrix like this will be called as adjacency hypermatrix. By using the definition of eigenvalues of hypermatrix given by Lim (Singular values and eigenvalues of tensors: a variational approach), the largest eigenvalue of hypergraph is the largest eigenvalue of its adjacency hypermatrix. In the end, the relationship between the largest eigenvalue of adjacency matrix of graph and its chromatic number remain fulfilled for the largest eigen value of adjacency hypermatrix of hypergraph with its chromatic number.

2010 Mathematics Subject Classification: 15A18.
Keywords: hypermatrix, eigenvalue, hypergraph, vertex, edge, adjacency hypermatrix, uniform, chromatic number.

CT-20. Results on the Roman domination vertex critical graphs

Nader Jafari Rad
Shahrood University of Technology
n.jafarirad@gmail.com

A Roman dominating function (or just RDF) on a graph $G = (V, E)$ is a function $f : V \longrightarrow \{0, 1, 2\}$ satisfying the condition that every vertex u for which $f(u) = 0$ is adjacent to at least one vertex v for which $f(v) = 2$. The weight of an RDF f is the value $f(V(G)) = \sum_{u \in V(G)} f(u)$. The *Roman domination number* of a graph G, denoted by $\gamma_R(G)$, is the minimum weight of a Roman dominating function on G. A graph G is Roman domination vertex critical if the Roman domination number of G is decreased under removal of any vertex. In this paper we present several bounds, characterizations and algorithmic results for the Roman domination number in the class of Roman domination vertex critical graphs.

2010 Mathematics Subject Classification: 05C69.
Keywords: domination, Roman domination, critical.

CT-21. Special factors and forbidden words of random Noble means words

Mark Camilo C. Mamaril*, Eden Delight P. Miro
Ateneo de Manila University, Philippines
mmarkcamilo@yahoo.com, eprovido@ateneo.edu

Let our alphabet be $\mathcal{A} = \{a, b\}$. A *word* w of length n over $\mathcal{A}$ is a sequence $w_1 w_2 \dots w_n$ of n letters from $\mathcal{A}$. We define the set of *bi-infinite words* over $\mathcal{A}$ to be $\mathcal{A}^{\mathbb{Z}} = \{(w_i)_{i\in\mathbb{Z}} : w_i \in \mathcal{A}\}$. For arbitrary but fixed $m \in \mathbb{N}$, the *random noble means substitution* is given by $\zeta_m : \begin{cases} a & \mapsto \begin{cases} ba^m & \text{with probability } p_0 \\ aba^{m-1} & \text{with probability } p_1 \\ \vdots & \\ a^m b & \text{with probability } p_m \end{cases} \\ b & \mapsto a \end{cases}$
where $(p_0, \dots, p_m)$ is a fixed probability vector, that is $p_i \geq 0$ and $\sum_{i=0}^{m} p_i = 1$. The map ζ_m acts locally on letter a as follows: for each occurrence of the letter a we decide independently which among the $m + 1$ possible realizations to choose. Consequently, we say that ζ_m is a *locally random substitution*. We define the *symbolic random noble means tiling space* Σ_m as the set of all elements of $\mathcal{A}^{\mathbb{Z}}$ such that for any $w \in \Sigma_m$ and for any subword u of w, there exists a power $k \in \mathbb{N}$ where u is a subword of some realisation of $\zeta_m^k(b)$. Denote by $F_n = F(\Sigma_m, n)$ the set of all subwords of length n of the words in Σ_m, and denote by F the union of F_n for all n. Every element of length n in F can be extended in at least one way to an element of length $n + 1$ by appending a letter to the right, we call those elements for which this can be done in two different ways as *right specials*. Similarly, the words $v \in F$ such that $av \in F$ and $bv \in F$ are called *left specials*. If an element v of F is both right special and left special, we say that v is *bispecial*. There are three kinds of bispecial elements, depending on the cardinality of the set $I = F \cap (\mathcal{A}v\mathcal{A})$. When I has four elements, v is a *strong bispecial*; when it has three elements v is an *ordinary bispecial*; and when it has only two elements, v is a *weak bispecial*. We show that, in the symbolic random noble means tiling space Σ_m, there are no weak bispecials in F. Furthermore, we also list the forbidden words w of length n of Σ_m; that is, w is a word over $\mathcal{A}$ but $w \notin F_n$.

2010 Mathematics Subject Classification: 05A05, 05B45, 37B10.
Keywords: word combinatorics, random substitution, symbolic dynamics, subword complexity.

CT-22. Some properties of matroids obtained from concept lattice approaches

Hua Mao
Department of Mathematics, Hebei University, Baoding 071002, China
yushengmao@263.net

Using the Hasse diagrams of concept lattices, we investigate the relations between matroids and geometric contexts, followed by judging a mathematical construction to be a matroid. We provide an idea to find out the dual of a matroid

from the ways of concept lattice drawing. In addition, we utilize the Hasse diagrams of concept lattices to discuss the minors of matroids, direct sum of matroids and the connectivity of a matroid. All the consequences demonstrate that the theory of concept lattice drawing can be used into matroids. This generalizes the applied fields of concept lattices.

2010 Mathematics Subject Classification: 05B35, 68R05, 06B75
Keywords: matroid, concept lattice, Hasse diagram, geometric lattice.

CT-23. A-differential of graphs under some binary operations

Cris L. Armada*, Sergio R. Canoy, Jr.
Mindanao State University-Iligan Institute of Technology, Iligan City, Philippines
invictuscris@yahoo.com, serge_canoy@yahoo.com

Let $G = (V(G), E(G))$ be an arbitrary graph and let $X \subseteq G$. The set $A(X) = X \cap N(X)$ consists of the non-isolates in X, where $N(X) = \{y \in V(G) : yx \in E(G) \text{ for some } x \in X\}$. Let $B(X)$ denotes the set of vertices in $V(G)\backslash X$ that has a neighbor in X. The *A-differential of* X is given by $\partial_A(X) = |B(X)| - |A(X)|$. The *A-differential of* G, denoted by $\partial_A(G)$, is equal to $max\{\partial_A(X) : X \text{ is a subset of } V(G)\}$. This paper gives the A-differentials of graphs resulting from some binary operations such as corona, join, and composition of graphs. It is also shown that the $\partial_A(G)$ is between 0 and $n-1$ for any graph G of order $n \geq 2$ and these bounds are sharp. The concept of A-differential becomes significant because it holds a number of applications in determining the minimum number of facilities and the corresponding strategic locations to guarantee maximum profit or benefit. The following are some important results obtained from the study:

1. *Let G and H be graphs of orders n and m, respectively.*
   (i.) *If either G or H is complete, then $\partial_A(G + H) = n + m - 1$.*
   (ii.) *If G and H are non-complete, then $\partial_A(G + H) = max\{n + m - 4, \partial_A(G) + m, \partial_A(H) + n\}$.*
2. *Let G be a connected graph of order n and $m \geq 2$. Then $\partial_A(G[K_m]) = nm - k$, where $k = min\{|T| + |A(T)| : T \text{ is a dominating set in } G\}$.*

2010 Mathematics Subject Classification: 05C69
Keywords: domination, corona, join, composition

CT-24. $(1,2)^*$-domination in graphs

Sergio R. Canoy, Jr.*[1], Shaleema A. Ariola[2]
[1]Dept. of Math. and Stat., MSU-Iligan Institute of Technology, Philippines
[2]Department of Mathematics, Basilan State College, Philippines
serge_canoy@yahoo.com, barbie_shall@ymail.com

Let $G = (V(G), E(G))$ be a simple graph. The *open neighbourhood* of a vertex v of G is the set $N_G(v) = \{u \in V(G) : uv \in E(G)\}$ and its *closed neighbourhood* is the set $N_G[v] = N_G(v) \cup \{v\}$. The degree of v, denoted by $deg_G(v)$, is equal to $|N_G(v)|$ and the maximum degree of G, denoted by $\Delta(G)$, is equal to $\max\{deg_G(v) : v \in V(G)\}$. The *open neighbourhood* of a subset S of $V(G)$ is the set $N_G(S) = \cup_{v\in S} N_G(v)$ and its *closed neighbourhood* is the set $N_G[S] = N_G(S) \cup S$. A subset S of $V(G)$ is a *dominating set* of G if $N_G[S] = V(G)$. It is a $(1,2)^*$-*dominating set* of G if $N_G[S] = V(G)$ (it is a dominating set) and for each $x \in V(G) \setminus S$ there exists $z \in S$ such that $d_G(x, z) = 2$. The smallest cardinality of a $(1,2)^*$-dominating set of G, denoted by $\gamma^*_{1,2}(G)$, is called the $(1,2)^*$-domination number of G. A subset D of $V(G)$ is a *point-wise non-dominating set* of G if for each $v \in V(G) \setminus S$, there exists $u \in S$ such that $v \notin N_G(u)$. The smallest cardinality of a point-wise non-dominating set of G, denoted by $pnd(G)$, is called the *point-wise non-domination number* of G. A dominating set S which is also a point-wise non-dominating set of G is called a *dominating-point-wise non-dominating set* of G. In this paper we characterize the $(1,2)^*$-dominating sets in the join, the corona, and the lexicographic product of graphs. Some of these characterizations utilize the concepts of point-wise non-domination and domination-point-wise non-domination. Further, we determine bounds for the $(1,2)^*$-domination number of some graphs obtained from these types of operations.

2010 Mathematics Subject Classification: 05C69.
Keywords: domination, $(1,2)^*$-domination, join, corona, lexicographic product.

CT-25. On locating-dominating sets of product graphs

Suhadi Wido Saputro
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
suhadi@math.itb.ac.id

Given a simple, connected, and finite graph G. The *open neighborhood* of a vertex v of G is defined as a vertex set $N_G(v) = \{u \in V(G) \mid uv \in E(G)\}$. The *locating-dominating number* of a graph G is defined as the cardinality of minimum of $W \subseteq V(G)$ such that for every two distinct vertices $u, v \in V(G) \setminus W$, $\emptyset \neq N_G(u) \cap W \neq N_G(v) \cap W \neq \emptyset$. In this paper, we consider a graph product between connected graphs G and H, which contains $H + K_1$ as its induced subgraph. In particular, we determine the locating-dominating number of joint product, corona product, and lexicographic product between G and H.

2010 Mathematics Subject Classification: 05C69, 05C76.

Keywords: corona product, joint product, lexicographic product, locating-dominating number, locating-dominating set.

CT-26. On the locating chromatic number of cubic Halin graphs

Ira Apni Purwasih*, Edy Tri Baskoro, Hilda Assiyatun, Djoko Suprijanto
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
ira_apni_p@students.itb.ac.id, {ebaskoro, hilda, djoko}@math.itb.ac.id

Let G be a connected graph. Let f be a proper k-coloring of G and $\Pi = \{R_1, R_2, \ldots, R_k\}$ be the ordered partition of $V(G)$ under the coloring f. For $v \in V(G)$, the *color code* $c_\Pi(v)$ of vertex v is the ordered k-tuple $(d(v, R_1), d(v, R_2), \ldots, d(v, R_k))$, where $d(v, R_i)$ is the distance from vertex v to set R_i. The coloring f is called a *locating coloring* of G if all vertices have distinct color codes. The smallest integer k such that G admits a locating k-coloring is called the *locating-chromatic number* of G and it is denoted by $\chi_L(G)$. A *Halin graph* $H(T)$ is a planar graph constructed from a plane embedding of tree T by connecting all the leaves of the tree (the vertices of degree 1) with a cycle that passes around the tree in the natural cyclic order defined by the embedding of the tree. If all vertices in this Halin graph has degree 3 then this graph is called cubic. In this paper, we give the recursive formula of the upper bound of the locating-chromatic number of some cubic Halin graphs. In particular, for small diameter we derive the locating-chromatic number of such graphs.

2010 Mathematics Subject Classification: 05C15, 05C12.
Keywords: locating-chromatic number, cubic, Halin.

CT-27. Some domination parameters in generalized Jahangir graph $J_{n,m}$

Roslan Hasni*[1], Safa Mtarneh[1], Doost Ali Mojdeh[2]
[1]Universiti Malaysia Terengganu, Terengganu, Malaysia
[2]Tafresh University, Tafresh, Iran
hroslan@umt.edu.my, S_math_1985_2009@yahoo, damojdeh@ipm.ir

Given a graph $G = (V, E)$, a dominating set S is a subset of vertex set V such that any vertex not in S is adjacent to at least one vertex in S. The domination number of a graph G is the minimum size of the dominating sets of G. In this paper, we investigate some results on domination number, total domination, connected and 2-domination number for generalized Jahangir graph $J_{n,m}$.

2010 Mathematics Subject Classification: 05C90.
Keywords: Jahangir graph, domination number, total domination number, connected domination number, 2-domination number.

CT-28. Are Ramsey algebras essentially semigroups

Zu Yao Teoh*, Wen Chean Teh
School of Mathematical Sciences, Universiti Sains Malaysia
teohzuyao@gmail.com, dasmenteh@usm.my

Abstracting Ellentuck's construction of a topological space showing that sets in the lower projective hierarchy of the reals have Ramsey properties analogous to the natural numbers, Carlson, some 30 years ago, developed a topological framework to the study of the combinatorics applicable to a wide variety of structures. For the class of spaces induced by algebras, homogeneous or heterogeneous, Carlson pointed out that a purely combinatorial study of these algebras without going through topological consideration is possible. This motivates the notion of a Ramsey algebra. The question as to exactly which algebras are Ramsey algebras has received the limelight soon after the notion was introduced. We will examine some possibilities by looking at a few specific structures resembling semigroups, which are Ramsey algebras. In particular, we will begin by examining how the nonassociative Moufang loop of nonzero octonions–structures that resemble semigroups, but which are not–fail to be Ramsey algebras. In addition, we will look at two heterogeneous structures consisting of matrices equipped with matrix operations. These are structures with semigroups embedded in them, but which turn out not to be (heterogeneous) Ramsey algebras. We are then led to suspect that all Ramsey algebras could well be semigroups and closely related structures.

2010 Mathematics Subject Classification: 05C55, 05D10.
Keywords: Ramsey algebra, Ramsey theory, semigroups, Moufang loops, octonions.

CT-29. Subdivision of graphs in $\mathcal{R}(mK_2, P_4)$

Kristiana Wijaya*, Edy Tri Baskoro, Hilda Assiyatun, Djoko Suprijanto
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
kristiana.w@students.itb.ac.id, {ebaskoro, hilda, djoko}@math.itb.ac.id

For given graphs G and H, the notation $F \to (G, H)$ to mean that every red-blue coloring of edges of F contains a red copy of G or a blue copy of H. The graph F is called a *Ramsey* (G, H)*-minimal graph* if it satisfies the following two conditions: (i) $F \to (G, H)$ and (ii) $(F - e) \nrightarrow (G, H)$, for each $e \in E(F)$. The *subdivision* of a graph G on the edge $e = uv$, denoted by $S(G(e, k))$, is a graph obtained from the graph G by removing edge e and inserting new k vertices $w_1, w_2, \cdots, w_k$, and new $k + 1$ edges uw_1, $w_k v$ and $w_i w_{i+1}$, for $i = 1, 2 \cdots, k - 1$. In this paper, we prove that if $F \in \mathcal{R}(mK_2, P_4)$ then the graph $S(F(e, 4))$ will be in $\mathcal{R}((m + 1)K_2, P_4)$, for any non-pendant edge e and for any m. By this theorem we could construct Ramsey minimal graphs for a matching versus P_4 from the previous known Ramsey minimal graphs of a smaller matching versus P_4.

2010 Mathematics Subject Classification: 05D10, 05C55.
Keywords: Ramsey minimal graph, edge-coloring, matching, subdivision, complete graph, path.

CT-30. On $(3P_2, 2C_3)$ and $(2P_3, 2C_3)$-classes graphs Ramsey minimal

I W. Sudarsana*, S. Musdalifah, Halimah, D. Winarsih
Tadulako University, Indonesia
sudarsanaiwayan@yahoo.co.id, selvymusdalifah@yahoo.com
{imahalimah018, desty.winarsih}@gmail.com

We consider that all graphs in this paper are finite, simple and undirected. Let F, G and H be any graphs, the notation $F \to (G, H)$ means that for any red-blue coloring of all edges in F contain either a red subgraph G or a blue subgraph H. In the other notation, $F \nrightarrow (G, H)$ denotes that there is a red-blue coloring of all edges of F with no red subgraph G and no blue subgraph H. A graph F is called a Ramsey (G, H)-minimal graph, if it satisfies the conditions (i). $F \to (G, H)$, and (ii). $F - e \nrightarrow (G, H)$ for any edges e in F. The class of all Ramsey (G, H)-minimal graph is denoted by $\Re(G, H)$. The main problems in Ramsey (G, H)-minimal graphs are the determination and the characterization of all graphs F belonging to $\Re(G, H)$. Because of the difficulties's, there are just a few results on the problems stated above, even for the combination of two small-order graphs or two simply-structured graphs G and H. Problem for finding class graph Ramsey minimal of small paths, i.e. $3P_2$ and $2P_3$, with respect to two small cycles, $2C_3$, is still open. In this paper, we have nine and four connected graphs in $\Re(3K_2, 2C_3)$ and $\Re(2P_3, 2C_3)$, respectively. We also obtain the following lemma and theorems.

Lemma 1: Let H be a connected graph. If $F \in \Re(nP_2, (n-2)H)$ then $(H \cup F) - e \nrightarrow (nP_2, (n-1)H)$ for every $e \in G$ and $n \geq 3$ is integer.

Theorem 1: If two distinct connected graphs F_1 and F_2 belong to $\Re(2P_2, C_3)$, then $C_3 \cup F_1 \cup F_2 \in \Re(3P_2, 2C_3)$.

Theorem 2: If three distinct connected graphs G_1, G_2 and G_3 belong to $\Re(P_3, C_3)$ then $G_1 \cup G_2 \cup G_3 \in \Re(2P_3, 2C_3)$.

2010 Mathematics Subject Classification: 05C55.
Keywords: Ramsey minimal, cycle, path.

CT-31. Some infinite families of Ramsey (P_3, P_n)-minimal graphs for small n

Desi Rahmadani*[1], Edy Tri Baskoro[1], Martin Bača[2], Hilda Assiyatun[1]
Andrea Semaničová-Feňovčíková[2]
[1]Combinatorial Mathematics Research Group, Institut Teknologi Bandung
[2]Dept. of Appl. Math. and Informatics, Technical University, Slovak Republic
desi.rahmadani33@students.itb.ac.id, {ebaskoro, hilda}@math.itb.ac.id
{martin.baca, andrea.fenovcikova}@tuke.sk

Let G and H be graphs. We write $F \to (G, H)$ if every red-blue coloring of the edges of F will create either a red subgraph isomorphic to G or a blue subgraph isomorphic to H. A graph F is a *Ramsey* (G, H)*-minimal graph* if $F \to (G, H)$ but

$F - e \nrightarrow (G, H)$ for every $e \in E(F)$. A (G, H)-*coloring* in F is a red-blue coloring in F such that neither a red G nor a blue H occurs. The set of all Ramsey (G, H)-minimal graphs (up to isomorphism) is denoted by $\mathcal{R}(G, H)$. The pair (G, H) will be called *Ramsey-finite* or *Ramsey-infinite* depending upon whether $\mathcal{R}(G, H)$ is finite or infinite. It is known that the pair (P_3, P_n), for $n \geq 6$ is Ramsey-infinite. However, it is a hard problem to characterize all graphs belonging to $\mathcal{R}(P_3, P_n)$ for any $n \geq 6$. In this paper, we construct some infinite families of graphs that belong to $\mathcal{R}(P_3, P_n)$, for $n = 6, 7$, and 8. The infinite families of such graphs are either trees or unicyclic graphs. We also give an algorithm to construct infinite families of trees belonging to $\mathcal{R}(P_3, P_n)$, for $n = 6, 7$, and 8.

2010 Mathematics Subject Classification: 05C55, 05D10.
Keywords: Ramsey minimal graph, coloring, tree, unicyclic graph.

CT-32. On locating-chromatic number for graphs with two homogenous components

Des Welyyanti*, Edy Tri Baskoro, Rinovia Simanjuntak, Saladin Uttunggadewa
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
deswelyyanti@students.itb.ac.id, {ebaskoro, rino, s_uttunggadewa}@math.itb.ac.id

The locating-chromatic number of a graph was introduced by Chartrand et al. in 2002. The concept of the locating-chromatic number is a marriage between graph coloring and the notion of graph partition dimension. Chartrand et al. determined the locating-chromatic number for trees, paths and double stars. However, the results on trees are still far from completeness. Asmiati et al. (2012) and Baskoro et al. (2013) characterized all graphs with locating-chromatic number 3. Until now, the study of the locating-chromatic numbers are limited for only connected graphs. Therefore, we introduced and applied the notion of the locating-chromatic numbers for disconnected graphs. Let c be a k-coloring of a (disconnected) graph $H(V, E)$ and $\prod = \{C_1, C_2, \cdots, C_k\}$ be the partition of $V(H)$ induced by c, where C_i is the set of all vertices receiving color i. The *color code* $c_{\prod}(v)$ of a vertex $v \in H$ is the ordered k-tuple $(d(v, C_1), d(v, C_2), \cdots, d(v, C_k))$, where $d(v, C_i) = min\{d(v, x)|x \in C_i\}$ and $d(v, C_i) < \infty$ for all $i \in [1, k]$. If all vertices of H have distinct color codes, then c is called a *locating-coloring* of H. The *locating-chromatic number* of H, denoted by $\chi'_L(H)$, is the smallest k such that H admits a locating-coloring with k colors, otherwise we say that $\chi'_L(H) = \infty$. In this paper, we determine the locating-chromatic number of a graph with two components. We give lower and upper bounds for the locating-chromatic number for such graphs. In particular, we determine such values if the components are homogeneous and/or the components has has certain locating-chromatic number.

2010 Mathematics Subject Classification: 05C12, 05C15.
Keywords: locating-chromatic number, disconnected, graph, component, coloring.

CT-33. Locating-chromatic number of the edge-amalgamation of trees

Dian Kastika Syofyan*, Edy Tri Baskoro, Hilda Assiyatun
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
diankastika@students.itb.ac.id, {ebaskoro, hilda}@math.itb.ac.id

The investigation on the locating-chromatic number of a graph was initiated by Chartrand *et al.* (2002). This concept is in fact a special case of the partition dimension of a graph. This topic has received much attention. However, the results are still far from satisfaction. We can define the locating-chromatic number of a graph G as the smallest integer k such that there exists a k-partition of the vertex-set of G such that all vertices have distinct coordinates with respect to this partition. As we know that the metric dimension of a tree is completely solved. However, the locating-chromatic numbers for most of trees are still open. For $i = 1, 2, \ldots, t$, let T_i be a tree with a fixed edge e_{o_i} called the terminal edge. The edge-amalgamation of all $T_i s$ denoted by Edge-Amal$\{T_i; v_{o_i}\}$ is a tree formed by taking all the T_is and identifying their terminal edges. In this paper, we study the locating-chromatic number of the edge-amalgamation of arbitrary trees. We give lower and upper bounds for their locating-chromatic numbers and show that the bounds are tight.

2010 Mathematics Subject Classification: 05C12, 05C15.
Keywords: edge-amalgamation, locating-chromatic number, terminal edge, tree.

CT-34. On commutative characterization of graph operations with respect to local metric dimension

L. Susilowati*[1], M. I. Utoyo[1], Slamin[2]
[1]Department of Mathematics, Universitas Airlangga, Indonesia
[2]Study Program of Information System, Universitas Jember, Indonesia
lilik_rofiudin@yahoo.co.id, m.i.utoyo@fst.unair.ac.id, slamin@unej.ac.id

Let G is connected graph with vertex set V(G) and $W = \{w_1, w_2, \ldots, w_k\} \subseteq V(G)$. The representation a vertex $v \in V(G)$ with respect to W is the ordered k-tuple $r(v|W) = (d(v, w_1), d(v, w_2), ..., d(v, w_k))$ where d(v,w) represents the distance between vertices v and w. The set W is called a local resolving set for G if every two adjacent vertices of G has a distinct representation with respect to W. A local resolving set containing a minimum number of vertices is called local basis for G. The local metric dimension of G, denoted by $dim_l(G)$, is the number of vertices in a local basis of G. In general, comb product and corona product are non-commutative operations in graph. However, these operations can be commutative with respect to local metric dimension for some graphs with certain conditions. In this paper, we determine the necessary and sufficient conditions of graphs in order to comb and corona products to be commutative operations with respect to local metric dimension.

2010 Mathematics Subject Classification: 05C30, 05C76, 05C12.

Keywords: local resolving set, local basis, comb product graph, corona product graph, commutative characterization.

CT-35. On the metric dimension of lollipop graph, Mongolian tent graph, and generalized Jahangir graph

Ardina Rizqy Rachmasari*, Tri Atmojo Kusmayadi
Department of Mathematics, Sebelas Maret University, Surakarta, Indonesia
ardinarr@student.uns.ac.id, tri.atmojo.kusmayadi@gmail.com

Let G be a graph with vertex set $V(G)$ and edge set $E(G)$. The distance $d(u, v)$ between vertex u and v in G is the length of the shortest path from u to v. A set of vertices in S resolves a graph G if every vertex is uniquely determined by its vector of distance to the vertices in S. The metric dimention of a graph G is the minimum cardinality of a resolving set. In this paper we study the metric dimension of lollipop graph, Mongolian tent graph, and Jahangir graph. Lollipop graph $L_{m,n}$ for $m \geq 3$ is the graph obtained by joining a complete graph K_m to a path graph P_n with a bridge. We obtain the metric dimension of lollipop graph is $m-1$. Mongolian tent graph $M_{m,n}$ is the graph obtained from the graph Cartesian product $P_m \times P_n$ for odd n by adding an extra vertex above the graph and joining every other vertex of the top row to the additional vertex. We have the metric dimension of Mongolian tent graph for $n = 3, 5$ is 3, the metric dimension of Mongolian tent graph for $n = 7, 9$ is $\lfloor \frac{n}{2} \rfloor$, and the metric dimension of Mongolian tent graph for $n \geq 11$ is $\lfloor \frac{n}{2} \rfloor - 1$. Generalized Jahangir graph $J_{m,n}$ for $n \geq 3$, is a graph consisting of a cycle C_{mn} with one additional vertex which is adjacent to m vertices of C_{mn} at distance n to each other on C_{mn}. We obtain the metric dimension of generalized Jahangir graph $J_{3,n}$ is $\lfloor \frac{n}{2} \rfloor$, the metric dimension of generalized Jahangir graph $J_{m,n}$ for m even is $\lfloor \frac{2n+2}{3} \rfloor$, and the metric dimension of generalized Jahangir graph $J_{m,n}$ for m odd is $\lceil \frac{n}{2} \rceil$.

2010 Mathematics Subject Classification: 05C12.
Keywords: metric dimension, resolving set, lollipop graph, Mongolian tent graph, generalized Jahangir graph.

CT-36. Characterization of completely k-magic regular graphs, $k \geq 3$

Arnold A. Eniego*[1], I.J.L Garces[2]
[1]National University, Manila, [2]Ateneo de Manila University
aaeniego@national-u.edu.ph, ijlgarces@ateneo.edu

Let $k \in \mathbb{N}$ and $c \in \mathbb{Z}_k$, where $\mathbb{Z}_1 = \mathbb{Z}$. A graph $G = (V(G), E(G))$ is said to be c-sum k-magic if there is a labeling $\ell : E(G) \to \mathbb{Z}_k \setminus \{0\}$ such that $\sum_{u \in N(v)} \ell(uv) \equiv c \pmod{k}$ for every vertex v of G, where $N(v)$ is the neighborhood of v in G. We say that G is completely k-magic whenever it is c-sum k-magic for every $c \in \mathbb{Z}_k$. In this paper, we characterize all completely k-magic regular graphs.

2010 Mathematics Subject Classification: 05C70, 05C78.

Keywords: regular graphs, graph factorization, k-magic graphs, completely k-magic graphs, sum spectrum.

CT-37. C_4-supermagic labeling of the grid graph

Rachel Wulan Nirmalasari Wijaya*, Thomas Kalinowski
The University of Newcastle, Australia
rachel.wijaya@uon.edu.au, thomas.kalinowski@newcastle.edu.au

A graph labeling is an assignment of integers to the vertices or edges, or both, subject to certain conditions. A simple graph $G = (V, E)$ admits an H-covering if every edge in E belongs to at least one subgraph of G isomorphic to H. A graph G is called H-magic if there is exist a one-to-one map $f : V \cup E \to \{1, 2, \ldots, |V|+|E|\}$ such that for every subgraph $H' = (V', E')$ of G isomorphic to H, $\sum_{v \in V'} f(v) + \sum_{e \in E'} f(e)$ is constant. Additionally, G is said to be H-supermagic if $f(V) = \{1, 2, ..., |V|\}$. In this talk, we study C_4-supermagic labeling of the grid graph $G_{m,n}$ for all values of m and n where C_4 is the cycle of length 4.

2010 Mathematics Subject Classification: 05C78.
Keywords: cycle-supermagic labeling, magic labeling, total labeling, grid graph.

CT-38. On the (super) edge-magic deficiency of graphs

A. A. G. Ngurah*[1], R. Simanjuntak[2]
[1]Universitas Merdeka Malang, Indonesia, [2]Institut Teknologi Bandung, Indonesia
ngurahram67@yahoo.com, rino@math.itb.ac.id

A graph G is called *edge-magic* if there exists a bijection f from $V(G) \cup E(G)$ to $\{1, 2, 3, \cdots, |V(G) \cup E(G)|\}$ such that $f(x) + f(xy) + f(y)$ is a constant for every edge xy in $E(G)$. An edge-magic graph G is called *super* if $f(V(G)) = \{1, 2, 3, \cdots, |V(G)|\}$. Furthermore, the *edge-magic deficiency* of a graph G is the nonnegative integer n such that $G \cup nK_1$ is an edge-magic graph. The *super edge-magic deficiency* of a graph G is either the minimum nonnegative integer n such that $G \cup nK_1$ is super edge-magic or $+\infty$ if there exists no such integer n. These parameters, the edge-magic deficiency and the super edge-magic deficiency, measure how "close" a graph to be a (super) edge-magic graph.

In this paper, we study the super edge-magic deficiency of join product graphs. We found a lower bound of the super edge-magic deficiency of join product of any connected graph with isolated vertices and an upper bound of the super edge-magic deficiency of join product of any super edge-magic graph with isolated vertices. Also, We study the super edge-magic deficiency of 2-regular graphs.

2010 Mathematics Subject Classification: 05C78.
Keywords: (super) edge-magic graph, (super) edge-magic deficiency, join product graph, 2-regular graph.

CT-39. A generalized shackle of any graph H admits a super H-antimagic total labeling

Dafik*[1], Moh. Hasan[2], Y. N. Azizah[1], I. H. Agustin[2]
[1]Mathematics Edu. Depart., University of Jember, Indonesia
[2]Mathematics Depart., University of Jember, Indonesia
{d.dafik, hasanfmipa}@unej.ac.id, yuli_nurazizah@yahoo.com, hestyarin@gmail.com

Let H be a graph a simple connected graph. A *shackle* of graph H, denoted by $G = shack(H, v, n)$, is a graph G constructed by non-trivial graphs $H_1, H_2, \ldots, H_n$ such that, for every $1 \leq s, t \leq n$, H_s and H_t have no a common vertex with $|s - t| \geq 2$ and for every $1 \leq i \leq n - 1$, H_i and H_{i+1} share exactly one common vertex v, called *connecting vertex*, and those $k - 1$ connecting vertices are all distinct. By a *generalized shackle* of graph, we mean the graph $G = shack(H, v, n)$ by replacing the connecting vertex by any subgraph $K \subset H$ and we denote such a graph as $G = gshack(H, K \subset H, n)$. Graph $G = gshack(H, K \subset H, n)$ admits a H-covering, if every edge in $E(G)$ belongs to at least one subgraph of G isomorphic to a given graph H. A graph G is said to be an (a, d)-H-antimagic total graph if there exist a bijective function $f : V(G) \cup E(G) \to \{1, 2, \ldots, |V(G)| + |E(G)|\}$ such that for all subgraphs isomorphic to H, the total H-weights $w(H) = \sum_{v \in V(H)} f(v) + \sum_{e \in E(H)} f(e)$ form an arithmetic sequence $\{a, a+d, a+2d, ..., a+(n-1)d\}$, where a and d are positive integers and n is the number of all subgraphs isomorphic to H. If such a function exist then f is called an (a, d)-H-antimagic total labeling of G. An (a, d)-H-antimagic total labeling f is called super if $f : V(G) \to \{1, 2, \ldots, |V(G)|\}$. In this paper, we study a super (a, d)-H antimagic total labeling of $G = gshack(H, e \in H, n)$ by using a partition techniques. The result shows that there exist a super(a, d)-H antimagic total labeling for almost feasible difference d up to the determined upper bound.

2010 Mathematics Subject Classification: 05C78.
Keywords: a generalized shackle of graph, H-antimagic, super total covering.

CT-40. Proof of a conjecture on super edge-magic deficiency of graphs

S. M. Hegde, Suresh Dara
Dept.of Math. & Comp.Sci., National Institute of Technology Karnataka, India
smhegde@nitk.ac.in, suresh.dara@gmail.com

In 1990, Acharya and Hegde have introduced the concept of strongly k-indexable graphs: A (p, q)-graph $G = (V, E)$ is said to be *strongly k-indexable* if it admits a strong k-indexer viz., an injective function $f : V(G) \to \{0, 1, 2, \ldots, p-1\}$ such that $f(u) + f(v) = f^+(uv) \in f^+(E(G) = \{k, k+1, k+2, \ldots, k+q-1\}$. When $k = 1$, a strongly k-indexable graph is simply called a strongly indexable graph. Enomoto et.al., have introduced the concept of super edge-magic graphs: A (p, q)-graph $G = (V, E)$ is said to be *super edge-magic* if it admits a bijection $f : V \cup E \to$

$\{1, 2, \ldots, p+q\}$ with $f(V) = \{1, 2, \ldots, p\}$ and $f(E) = \{p+1, p+2, \ldots, p+q\}$ such that $f(u) + f(v) + f(uv) = c(f)$, $u, v \in V$ where $c(f)$ is a constant. Figueroa-Centeno et.al., have introduced the notion of super edge-magic dificiency of graphs: Super edge-magic defiency of graph G is the minimum number of isolated vertices added to G so that the resulting graph is super edge-magic. They conjectured that *super edge-magic deficiency of complete bipartite graph* $K_{m,n}$ *is* $(m-1)(n-1)$ and proved it for the case $m = 3$. Hegde et.al., proved this conjecture is true for $m = 3, 4$ and 5, using the concept of strongly k-indexable labelings. *In this paper we prove the conjecture, using the concept of strongly* k*-indexable labelings.*

2010 Mathematics Subject Classification: 05C78.
Keywords: strongly k-indexable graphs, super edge-magic deficiency of graphs.

CT-41. On graph labeling and deficiency of antimagic types

Tao-Ming Wang
Tunghai University, Taichung, Taiwan
wang@thu.edu.tw

An **antimagic** edge labeling of a finite simple undirected graph with q edges is a bijection from the set of edges to the set of integers, $f : E(G) \to \{1, 2, \cdots, q\}$, such that the vertex sums are pairwise distinct, where the vertex sum at one vertex is the sum of labels of all edges incident to such vertex. A graph is called antimagic if it admits an antimagic edge labeling. N. Hartsfield and G. Ringel conjectured in 1990 that all connected graphs except K_2 are anti-magic, which remains open till today. Over the past decade, there have been many extensive work in literature regarding this concept and related notions. An (a, d)**-antimagic** edge labeling of G is an antimagic edge labeling with the additional property that the vertex sums form an arithmetic sequence starting from a and having common difference d, where a and d are two positive integers. In this paper we investigate the existence of $(a, 1)$-antimagic labeling for regular graphs. Also we define and study a new concept **antimagic deficiency**, as an extension of antimagic labeling, for measuring how far a graph is away from being an antimagic graph. The antimagic deficiency is defined as the minimum k such that the edge labeling $f : E(G) \to \{1, 2, \cdots, q+k\}$ is antimagic. Furthermore the antimagic deficiency of certain disconnected graphs are studied.

2010 Mathematics Subject Classification: 05C78, 05C22.
Keywords: antimagic labeling, (a, d)-antimagic labeling, antimagic deficiency, regular graph, disconnected graph.

CT-42. On metric graphic sets

Jose B. Rosario*, Ian June L. Garces
Department of Mathematics, Ateneo de Manila University
rosario.trolls@yahoo.com, ijlgarces@ateneo.edu

For an ordered subset $W = \{w_1, w_2, w_3, \ldots, w_k\}$ of vertices in a connected graph G and a vertex v of G, the metric representation of v with respect to W is the k-vector $r(v|W) = (d(v, w_1), d(v, w_2), d(v, w_3), \ldots, d(v, w_k))$, where $d(v, w_i)$ is the distance of the vertices v and w_i in G. The set W is called a resolving set of G if $r(u|W) = r(v|W)$ implies $u = v$. The metric dimension of G, denoted by $\beta(G)$, is the minimum cardinality of a resolving set of G, and a resolving set of G with cardinality equal to its metric dimension is called a metric basis of G. A set T of vectors is called a positive lattice set if all the coordinates in each vector of T are positive integers. A positive lattice set T consisting of n k-vectors is called a metric graphic set if there exists a simple connected graph G of order $n + k$ with $\beta(G) = k$ such that $T = \{r(u_i|S) : u_i \in V(G)\backslash S, 1 \leq i \leq n\}$ for some metric basis $S = \{s_1, s_2, \ldots, s_k\}$ of G. If such G exists, then we say G is a metric graphic realization of T. In this work, we introduce the concept of metric graphic sets anchored on the concept of metric dimension and provide some characterizations. We also give necessary and sufficient conditions for any positive lattice set consisting of 2 k-vectors to be a metric graphic set. We provide an upper bound for the sum of all the coordinates of any metric graphic set.

2010 Mathematics Subject Classification: 05C12.
Keywords: metric basis, metric dimension, metric graphic set, metric graphic realization, positive lattice set, resolving set.

CT-43. On the total resolving number of wheel-like graphs

Hikmatiarahmah Kekaleniate*, Edy Tri Baskoro
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
hikmatiarahmah@students.itb.ac.id, ebaskoro@math.itb.ac.id

Let G be a connected graph. Let $S = \{s_1, s_2, \cdots, s_k\}$ be a subset of $V(G)$. For any $v \in (V(G)$, the coordinate of v with respect to S is $f(v) = (d(v, s_1), d(v, s_2), \cdots,$- $d(v, s_k))$. If distinct vertices in V have distinct coordinates, then S is called a resolving set of G. The cardinality of a minimum resolving set of G is called the metric dimension of G, and it is denoted by $\beta(G)$. A resolving set S is called a total resolving set if the induced subgraph $\langle S\rangle$ has no isolated vertices. The cardinality of a total minimum resolving set of G is called the total resolving number of G and it is denoted by $tr(G)$. For any graph G, an upper bound has been obtained, namely $tr(G) \leq 2\beta(G)$. In this paper, we determine the values of $tr(W_n)$, $tr(f_n)$, $tr(J_{2n})$ where W_n is a wheel on $n + 1$ vertices, f_n is a fan on $n + 1$ vertices, and J_{2n} is a Jahangir graph on $2n + 1$ vertices.

2010 Mathematics Subject Classification: 05C15, 05C12.
Keywords: total resolving set, total resolving number, wheels, fans, Jahangir graph.

CT-44. On the partition dimension of two-component graphs

Debi Oktia Haryeni*[1], Edy Tri Baskoro[1], Suhadi Wido Saputro[1], Martin Bača[2] Andrea Semaničová-Feňovčíková[2]
[1]Combinatorial Mathematics Research Group, Institut Teknologi Bandung
[2]Technical University in Košice, Slovakia
debi_oktia_hy@students.itb.ac.id, {ebaskoro, suhadi}@math.itb.ac.id,
{martin.baca, andrea.fenovcikova}@tuke.sk

Given a (disconnected) graph $G = (V, E)$ and an ordered k-partition $\Pi = \{S_1, S_2, \ldots, S_k\}$ of $V(G)$. If all distances $d(v, S_i)$ of v to S_i are finite for each $v \in V(G)$ and all S_i, then the representation of v with respect to Π, denoted by $r(v|\Pi)$, is $(d(v, S_1), d(v, S_2), \cdots, d(v, S_k))$. The k-partition Π is a resolving partition of G if all vertices have distinct representations. The smallest integer k (if it is finite) such that there is a resolving k-partition of $V(G)$ is called the partition dimension of G and denoted by $pd(G)$ or $pdd(G)$ for connected or disconnected G, respectively. If there is no such an integer k such that G has a $k-$resolving partition, then we say that $pdd(G) = \infty$. Most of results on the partition dimension are known only for connected graphs. There are only few results for disconnected graphs. In this paper, we continue investigating the partition dimension for disconnected graphs. We determine the partition dimension for some classes of disconnected graphs G consisting of two components. If $G = G_1 \cup G_2$, then we also give the bounds of the partition dimension $pdd(G)$ if $G_1 = P_n$ or if $pd(G_1) = pd(G_2)$.

2010 Mathematics Subject Classification: 05C12, 05C15.
Keywords: partition dimension, disconnected graph, component.

CT-45. On the partition dimension of antiprism graph, Mongolian tent graph, and stacked book graph

Tia Apriliani*, Tri Atmojo Kusmayadi
Departement of Mathematics, Sebelas Maret University, Surakarta, Indonesia
tiaapriliani@student.uns.ac.id, tri.atmojo.kusmayadi@gmail.com

Let G be a connected graph with $v \in V(G)$ and $S \subseteq V(G)$. The distance between v and S is defined by $d(v, S) = min\{d(v, x)|x \in S\}$. For an ordered $k-$partition $\Pi = \{S_1, S_2, \ldots, S_k\}$ of $V(G)$, the representation of v with respect to Π is $r(v|\Pi) = (d(v, S_1), d(v, S_2), \ldots, d(v, S_k))$. If the representation of each $v \in V(G)$ with respect to Π are distinct, then Π is called a resolving partition of $V(G)$. The minimum cardinality of resolving partition of $V(G)$ is called a partition dimension of G, denoted by $pd(G)$. In this paper, we study the partition dimension of an antiprism graph, a mongolian tent graph, and a stacked book graph. Antiprism graph A_n for $n \geq 3$ is a regular graph which has 4 degrees with $2n$ vertices and $4n$ edges. It consists of outer and inner C_n, then the two cycles are connected by edge $v_i u_i$ and $v_i u_{1+i(mod\, n)}$ for $i = 1, 2, 3, \ldots, n$. We obtain the partition dimension of antiprism graph A_n is 4 for $m \geq 3$. Mongolian tent graph $M_{m,n}$ for $m \geq 2$, $n \geq 3$ is

the graph obtained from the graph cartesian product $P_m \times P_n$ for odd n by adding an extra vertex above the graph and joining every other vertex of the top row to the additional vertex. The partition dimension of mongolian tent graph consist of four cases. The first case, for $m \geq 2$, $n = 3, 5$ we obtain $pd(M_{m,n})$ is 3, for $m \geq 2$, $n = 6i + 1$ where $i \in \mathbb{N}$ we obtain $pd(M_{m,n})$ is $\frac{n+5}{3}$, for $m \geq 2$, $n = 6i + 3$ where $i \in \mathbb{N}$ we obtain $pd(M_{m,n})$ is $\frac{n+3}{3}$, and for $m \geq 2$, $n = 6i + 5$ where $i \in \mathbb{N}$ we obtain $pd(M_{m,n})$ is $\frac{n+4}{3}$. Stacked book graph $B_{m,n}$ for $m \geq 3$, $n \geq 2$ is defined as the graph cartesian product $S_m \times P_n$ where S_m is a star graph and P_n is the path graph on n vertices. We obtain the partition dimension of stacked book graph $B_{m,n}$ is m for $m \geq 3$, $n \geq 2$.

2010 Mathematics Subject Classification: 05C12.
Keywords: partition dimension, resolving partition, mongolian tent graph, stacked book graph.

CT-46. On the metric dimension of wheel related graphs

Muhammad Imran[1,2], Syed Ahtsham Ul Haq Bokhary[3], Zil-e-Shams[3]
[1]National University of Sciences and Technology, Islamabad, Pakistan
[2]University of the Free State, South Africa
[3]Bahaudin Zakariya University, Multan, Pakistan
imrandhab@gmail.com, sihtsham@gmail.com

If G is a connected graph, the *distance* $d(u, v)$ between two vertices $u, v \in V(G)$ is the length of a shortest path between them. Let $W = \{w_1, w_2, \ldots, w_k\}$ be an ordered set of vertices of G and let v be a vertex of G. The *representation* $r(v|W)$ of v with respect to W is the k-tuple $(d(v, w_1), d(v, w_2), \ldots, d(v, w_k))$. W is called a *resolving set* or a *locating set* if every vertex of G is uniquely identified by its distances from the vertices of W, or equivalently, if distinct vertices of G have distinct representations with respect to W. A resolving set of minimum cardinality is called a *metric basis* for G and this cardinality is the *metric dimension* of G, denoted by $\beta(G)$. Metric dimension is a generalization of affine dimension to arbitrary metric spaces (provided a resolving set exists). The metric dimension of some wheel related graphs are studied recently in [H. M. A. Siddiqui, M. Imran, Appl. Math. Comput. $244(2014), 624 - 632$]. In this paper, we study the metric dimension of wheels with k consecutive missing spokes denoted by $W_{n,k}$. We compute the exact value of metric dimension of $W_{n,k}$ which shows that wheels with consecutive missing spokes have unbounded metric dimension. It is natural to ask for characterization of graphs with unbounded metric dimension. The exchange property for resolving set of $W_{n,k}$ has also been studied in this paper and it is shown that exchange property of the bases in a vector space does not hold for minimal resolving sets of wheels with k-consecutive missing spokes denoted by $W(n, k)$.

2010 Mathematics Subject Classification: 05C12.
Keywords: metric dimension, wheel, missing spokes, exchange property.

CT-47. On the chain blockers of a poset

Sarfraz Ahmad
COMSATS Institute of Information Technology, Lahore
sarfrazahmad@ciitlahore.edu.pk

For a poset P we say that a subset $A \subseteq P$ is a chain blocker if it is an inclusion-wise minimal subset of P that contains at least one element from every maximal chain. Let $P = C_a \times C_b$ be a poset where C_i is the chain $1 < \cdots < i$. In a recent paper by Ahmad/Welker the chain blockers of P were studied for some special cases and provided a new combinatorial interpretation of the convoluted Catalan numbers introduced by Catalan in 1887. In this talk we will discuss set of all chain blockers for the class of posets $P = C_a \times C_b$ for $a \leq 5$. We will finish with algebraic consequences and some open problems. Let $A = \{(1,1),(1,2),\ldots,(1,b),(2,b),\ldots,(a,b)\}$ and $B \subseteq P$ be a chain blocker. Then we prove that $A \cap B$ contains exactly one element. This result is used to prove that if B is a chain-blocker for $C_2 \times C_b$ then either $|B| = 1$ or $B = \{(1,j),(2,j')\}$, where $1 \leq j-1 \leq j' \leq b-1$. For $P = C_3 \times C_b$, the number of chain blockers of P is given by $\frac{1}{6}(a^2+2)(a+9)$. For $P = C_4 \times C_b$ the number of all chain blockers of P is given by $\frac{1}{24}b^4 + \frac{7}{12}b^3 - \frac{37}{24}b^2 - \frac{85}{12}b + 4 + 2^{b+2}$. For the case $a = 5$, let $S_i(j) = \{(1,j),(2,j),\ldots,(i,j)\} \subset P$. An *i-shelter* of $S_i(j)$ is a subset C of $P \setminus \{\mathcal{R}(P), \mathcal{L}(P)\}$ with the property that each maximal chain of P containing $v \in S_i(j)$ contains at least one element of C and C is inclusion wise minimum with this property. We used this definition to find the number of chain blockers of $P = C_5 \times C_b$. The initial motivation for this work comes from our algebraic and enumerative interest in chain blocker. We are interested in chains blockers as they appear for a poset P as the minimal nonfaces of the simplicial complex Δ_P^* which is Alexander dual to the simplicial complex whose minimal non-faces are the maximal chains in P. In geometric combinatorics to a partially ordered set P one usually associates the simplicial complex $\Delta(P)$ of all linearly ordered subsets of P. Its maximal faces are the maximal chains in P. If instead one defines Δ_P as the simplicial complex whose minimal nonfaces are the maximal chains in P. Then it is easily seen that the minimal nonfaces of the Alexander dual $\Delta_P^* = \{A \subseteq P \mid P \setminus A \notin \Delta\}$ are exactly the chain blockers of P.

2010 Mathematics Subject Classification: 05E40, 13F20, 13F55.
Keywords: Catalan number, chain blocker, partially ordered set.

CT-48. Graceful labeling of dihedral Cayley graphs

Maria Linda C. Cabillan*, Victoriano I. Ferrer Jr, Noelyn Anne A. Daria
Jet Lee L. Tulas, Albert S. Turalba*
Saint Louis University, Baguio City, Philippines
marialindacabillan@yahoo.com, ferrervicoy@gmail.com, daria.anne, @yahoo.com
tulas_jetlee@yahoo.com.ph, jha_at914@yahoo.com

After Rosa introduced graceful labeling in 1967, many researches were conducted to investigate labelings of different kinds of graphs. However, very few

researches have been made on the graceful labeling of Cayley graphs. This study looks into the graceful labeling of the Cayley graphs of the Dihedral group,D_{2n}. The nature of the graphs with specific generating sets were investigated and associated to graceful labelings. It was found in this study that dihedral Cayley graphs formed by generating sets with order one are all not graceful. Moreover, dihedral Cayley graphs formed by considering generating sets consisting of all vertices corresponding to rotation symmetries except the identity element are not graceful. If the generating set consists of all reflection symmetries, the dihedral Cayley graph is graceful. Complete dihedral Cayley graphs are not graceful.

2010 Mathematics Subject Classification: 05C78, 97K30, 05C25.
Keywords: graceful labeling, dihedral Cayley graphs, dihedral group, Cayley graph, graph labeling, graph theory.

CT-49. On the total irregularity strength of several types of trees

Meilin I. Tilukay*[1], A. N. M. Salman[2]
[1]Department of Mathematics, Universitas Pattimura
[2]Combinatorial Mathematics Research Group, Institut Teknologi Bandung
meilin.tilukay@fmipa.unpatti.ac.id, msalman@math.itb.ac.id

A totally irregular total k-labeling $\lambda : V \cup E \to \{1, 2, \cdots, k\}$ of a graph G is a total labeling such that for any different vertices x and y of G, their weights $wt(x)$ and $wt(y)$ are distinct, and for any different edges e and f of G, their weights $wt(e)$ and $wt(f)$ are distinct. The weight $wt(x)$ of a vertex x is the sum of the label of x and the labels of all incident edges with x, and the weight $wt(e)$ of an edge e is the sum of the label of e and the labels of both vertices incident with e. The minimum value k for which a graph G has a totally irregular total k-labeling is called the total irregularity strength of G, denoted by $ts(G)$. In this paper we determine the total irregularity strength for several types of trees, namely amalgamation of stars, banana trees, and fire crackers.

2010 Mathematics Subject Classification: 05C78.
Keywords: amalgamation of star, banana tree, fire crackers, totally irregular total k-labeling, total irregularity strength.

CT-50. Total vertex irregularity strength of trees with maximum degree five

Susilawati*, Edy Tri Baskoro, Rinovia Simanjuntak
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
Susilawati_nurdin@student.itb.ac.id, {ebaskoro, rino}@math.itb.ac.id

Let G be a connected graph with the vertex-set $V(G)$ and the edge-set $E(G)$. A total labeling $f : V \cup E \to \{1, 2, \ldots, k\}$ is called a *vertex irregular total k-labeling* of G if every two distinct vertices x and y in $V(G)$ satisfies $wt(x) \neq wt(y)$, where $wt(x) = f(x) + \sum_{xz \in E(G)} f(xz)$. The *total vertex irregularity strength* of G, denoted by $tvs(G)$, is the minimum k for which G has a vertex irregular total k-labeling.

In 2010, Nurdin, Baskoro, Salman and Gaos conjectured that the total vertex irregularity strength of any tree T is only determined by the number of its vertices of degrees 1, 2 and 3. Precisely, they conjectured that $tvs(T) = \max\{t_1, t_2, t_3\}$, where $t_i = \lceil (1 + \sum_{j=1}^{i} n_i)/(i+1) \rceil$ and n_i be the number of vertices of degree $i \in [1, 3]$. In this paper, we determine the total vertex irregularity strength of trees with maximum degree five. We prove that in any tree T with maximum degree five, there is an $i \in \{1, 2, 3\}$ such that $t_i \geq \max\{t_4, t_5\}$. As a consequence, tvs of such a tree T is at least $\max\{t_1, t_2, t_3\}$. We also give some conditions for such trees with maximum degree five whose $tvs(T) = \max\{t_1, t_2, t_3\}$.

2010 Mathematics Subject Classification: 05C78, 05C05.
Keywords: irregularity strength, total vertex irregularity strength, tree.

CT-51. The minimal size of rainbow 2-connected graphs

D. Resty*[1], A. N. M. Salman[2]
[1]PT. Samsung Electronics Indonesia, Samsung R&D Institute Indonesia
[2]Combinatorial Mathematics Research Group, Institut Teknologi Bandung
restydeniawanty@gmail.com, msalman@math.itb.ac.id

Let $G = (V(G), E(G))$ be a simple, finite, and connected graph. Let ℓ be a positive integer and $G = (V(G), E(G))$ be a nontrivial ℓ-connected graph. Let k be a positive integer, define an edge k-coloring, $c : E(G) \to \{1, 2, ..., k\}$ where adjacent edges may be colored the same. Let $x, y \in V(G)$, an $x - y$ path in G is called a rainbow path, if there are no two edges with the same color in this path. Let q be a positive integer with $q \leq \ell$, a k-coloring c is called q-rainbow k-coloring, if for any two distinct vertices x and y in G, there are q internally disjoint $x - y$ rainbow paths. A graph G which has been colored by q-rainbow k-coloring is called rainbow q-connected. The rainbow $q-$connection number of G, denoted by $rc_q(G)$, is the minimum positive integer k such that G has a q-rainbow k-coloring. Furthermore, the minimal size of rainbow 2-connected graph with rainbow 2-connection number at most k is denoted by $t_2(n, k)$. In this paper we determine upper bounds of $t_2(n, k)$ for $k \in \{2, ..., n-3\}$ and exact values of $t_2(n, k)$ for $k \in \{n-2, n-1, n\}$.

2010 Mathematics Subject Classification: 05C15, 05C40, 05C45.
Keywords: edge coloring, graph, hamiltonian, minimal size, rainbow 2-connected, rainbow connection number, rainbow path.

CT-52. On the total disjoint irregularity strength of wheels and related graphs

Meilin I. Tilukay*[1], A. N. M. Salman[2], F. Y. Rumlawang[1]
[1]Universitas Pattimura, [2]Institut Teknologi Bandung
meilin.tilukay@fmipa.unpatti.ac.id, msalman@math.itb.ac.id, rumlawang@fmipa.unpatti.ac.id

A totally irregular total k-labeling of a graph $G = (V, E)$ is a total labeling such that G has a total edge irregular labeling and a total vertex irregular labeling at

the same time.The total irregularity strength of a graph G is the minimum value k such that G has a totally irregular total k-labeling, denoted by $ts(G)$. This notion was introduced by Marzuki, Salman, and Miller. Observing the edge-weight set $W(E)$ and the vertex-weight set $W(V)$ of G which induced by $ts(G)$, it may be found that the intersection set $W(E) \cap W(V)$ is a nonempty set. Considering this property, Tilukay and Salman defined a new parameter called *a totally disjoint irregular total labeling* of a graph G as a total labeling $\lambda : V \cup E \to \{1, 2, \cdots, k\}$ which satisfies: (i) for any two vertices $x \neq y \in V$, $w(x) \neq w(y)$; (ii) for any two edges $x_1y_1 \neq x_2y_2 \in E$, $w(x_1y_1) \neq w(x_2y_2)$; (iii) $W(V) \cap W(E) = \emptyset$; where $w(x) \in W(V)$ is the sum of the label x and the labels of all edges incident to x and $w(x_1y_1) \in W(E)$ is the sum of the labels of x_i, y_i and x_1y_1. The minimum value k such that G has a totally disjoint irregular total labeling is called *the total disjoint irregularity strength* of G, denoted by $ds(G)$. Tilukay and Salman have determined the exact values *ds* of paths, cycles, stars, and complete graphs. This paper deals with the total disjoint irregularity strength of wheels and related graphs. We determine the exact values of the total disjoint irregularity strength of wheels, fans, friendships, gears, triangular books, and flowers.

2010 Mathematics Subject Classification: 05C78.
Keywords: total disjoint irregularity strength, total edge irregular labeling, total irregularity strength, total vertex irregular labeling.

CT-53. Constructions of encryption key by using a super H-antimagic total graph

A. C. Prihandoko*[1], Dafik[2], Slamin[1], A. I. Kristiana[2]
[1]Information System Dept. University of Jember, Indonesia
[2]Mathematics Edu. Dept. University of Jember, Indonesia
antoniuscp@gmail.com, {d.dafik, slamin}@unej.ac.id, arikakristiana@gmail.com

The strength of cryptosystem relays on the management of encryption key. The key should be managed such that it is hard for any intruder to analyze the key. Thus, the main issue is how to make the relation between plaintext, ciphertext and the key is hidden. This paper will study the use of super (a, d)-H antimagic total graph in developing an encryption key to achieve the security. Let H be a simple, connected and undirected graph. A graph $G = (V, E)$ is said to be a super (a, d)-H-antimagic total graph if there exist a one-to-one map $f : V(G) \cup E(G) \to \{1, 2, \ldots, |V(G)| + |E(G)|\}$ such that for all subgraphs isomorphic to H, the total H-weights $w(H) = \sum_{v \in V(H)} f(v) + \sum_{e \in E(H)} f(e)$ form an arithmetic sequence $\{a, a + d, a + 2d, ..., a + (s - 1)d\}$, where a and d are positive integers and s is the number of all subgraphs isomorphic to H, and $f : V(G) \to \{1, 2, \ldots, |V(G)|\}$. The resulting super (a, d)-H antimagic total graph can potentially generates a complex key, thus by using such graph we can get a secure cryptosystem.

2010 Mathematics Subject Classification: 05C78.
Keywords: super H-antimagic total graph, cryptosystem, encryption.

CT-54. The r-dynamic chromatic number of several classes of graphs

Dafik*[1], I. H. Agustin[2], D. E. W. Meganingtyas[2], K. D. Purnomo[2]
M. D. Tarmidzi[2], N. I. Wulandari[2]
[1]Mathematics Edu. Dept. University of Jember, Indonesia
[2]Mathematics Dept. University of Jember, Indonesia
d.dafik@unej.ac.id, {hestyarin, deviekawms, k.dwipurnomo}@gmail.com,
tarmidzidicky@rocketmail.com, n.icawulandari@gmail.com

Let G be a simple, connected and undirected graph. Let r, k be natural numbers. By a proper k-coloring of a graph G, we mean a map $c : V(G) \to S$, where $|S| = k$, such that any two adjacent vertices receive different colors. An r-dynamic k-coloring is a proper k-coloring c of G such that $|c(N(v))| \geq min\{r, d(v)\}$ for each vertex v in $V(G)$, where $N(v)$ is the neighborhood of v and $c(S) = \{c(v) : v \in S\}$ for a vertex subset S. The r-dynamic chromatic number, written as $\chi_r(G)$, is the minimum k such that G has an r-dynamic k-coloring. By simple observation it is easy to see that $\chi_r(G) \leq \chi_{r+1}(G)$, however $\chi_{r+1}(G) - \chi_r(G)$ does not always show a small difference for any r. Thus, finding an exact value of $\chi_r(G)$ is significantly useful. In this paper, we will study some of them especially when G are special graphs and its operations.

2010 Mathematics Subject Classification: 05C78.
Keywords: r-dynamic chromatic number, graph coloring, special graphs.

CT-55. Game chromatic number and game coloring number of Hanoi graph

Emrah Akyar*, Ummahan Akcan, Handan Akyar
Anadolu University, 26470 Eskisehir, Turkey
{eakyar, ummahanakcan, hakyar}@anadolu.edu.tr

In this study we consider a graph coloring game. Let $G = (V, E)$ be a finite simple graph and X be a set of colors. The game chromatic number of G is defined via a two-person finite game. Two players, generally called Alice and Bob, with Alice going first, alternatively color the uncolored vertices of G with a color from a color set X, such that no two adjacent vertices have the same color. Bob wins if at any stage of the game before the G is completely colored, one of the players has no legal move; otherwise, that is, if all the vertices of G are colored properly, Alice wins. The *game chromatic number* of G is the least number of colors in the color set X for which Alice has a winning strategy. The game coloring number of G is defined by modifying the rules of the coloring game as follows. The players fix a positive integer k, and instead of coloring vertices, only mark an unmarked vertex each turn. Bob wins if at some stage, some unmarked vertex has k marked neighbors, while Alice wins if this never happens. The *game coloring number* of G is defined as the least number k for which Alice has a winning strategy. We find exact values for the game coloring number of the Sierpinski graphs $S(n, k)$ for $n \geq 1$ and $k \geq 1$. Furthermore, game chromatic number of the Hanoi graph H_n is determined.

2010 Mathematics Subject Classification: 05C15, 05C57, 91A43.
Keywords: game chromatic number, game coloring number, Hanoi graph.

CT-56. Scrambling index of a class of two-colored two cycles whose lengths differ by 2

Mulyono[1], Saib Suwilo*[2], Hari Sumardi[2]
[1]State University of Medan, Indonesia, [2]University of Sumatera Utara, Indonesia
mulyonomath@yahoo.com, saibwilo@gmail.com, arie_gundul@rocketmail.com

A two-colored digraph is a digraph each of whose arcs is colored by red or blue. For nonnegative integers h and ℓ, an (h,ℓ)-walk in a two-colored digraph is a walk of length $h+\ell$ consisting of h red arcs and ℓ blue arcs. A two-colored digraph $D^{(2)}$ is primitive provided that there are nonnegative integers h and ℓ such that for each pair of vertices u and v in $D^{(2)}$ there is an (h,ℓ)-walk from u to v. The scrambling index of a primitive two-colored digraph $D^{(2)}$, denoted by $k(D^{(2)})$ is the smallest positive integer $h+\ell$ over all nonnegative integers h and ℓ such that for each pair of vertices u and v in $D^{(2)}$ there is a vertex w in $D^{(2)}$ with the property that there is an (h,ℓ)-walk from u to w and there is an (h,ℓ)-walk from v to w. For some integers s and c with $s \geq 5$ is odd and $2 \leq c \leq s$, we discuss the scrambling index of primitive two-colored digraphs on $n = 2s+2-c$ vertices consisting of two cycles $C_1 : v_1 \to v_2 \to \cdots \to v_c \to v_{c+1} \to v_s \to v_1$ and $C_2 : v_1 \to v_2 \to \cdots \to v_c \to v_{s+1} \to \cdots \to v_n \to v_1$ of length s and $s+2$, respectively. For such primitive two-colored digraph $D^{(2)}$ that has no consecutive blue arcs, we present formulae for scrambling index of $D^{(2)}$ that depends on s and the position of of specific red paths of length 2. Our results show that if $D^{(2)}$ has a unique $(2,0)$-path $v_a \to v_{a+1} \to v_{a+2}$ for some $1 \leq a \leq c-2$, then $k(D^{(2)}) = s^2+s-1-a$ and if $D^{(2)}$ has two $(2,0)$-paths, then $k(D^{(2)}) \geq s^2+s-1$.

2010 Mathematics Subject Classification: 05C20, 05C50.
Keywords: two-colored digraph, primitive digraph, scrambling index, two cycles.

CT-57. Perfect Matching with Restriction in Uncertain Network

I. Rosyida*[1,2], Jin Peng[3], Lin Chen[3] Widodo[2], Ch. Rini Indrati[2], Kiki A. Sugeng[4]
[1]Gadjah Mada University, [2]Semarang State University
[3]Huanggang Normal University, Hubei, China, [4]University of Indonesia
iisisnaini@gmail.com, pengjin01@tsinghua.org.cn, chenlinalbert@126.com
widodo_mathugm@yahoo.com, rinii@ugm.ac.id, kiki@ui.ac.id

Let G be a crisp weighted complete bipartite graph with bipartition (X,Y) where $X = \{x_1, x_2, \ldots, x_n\}$ and $Y = \{y_1, y_2, \ldots, y_n\}$. Each edge x_iy_j in G has a weight $w_{ij} = w(x_iy_j)$ and all the weights are presented by a matrix $W = (w_{ij})_{n\times n}$. A subset M of $E(G)$ is called a matching if each pair of edges in M have different endpoints. A vertex x in G is said to be M-saturated if there is an edge of M which is incident with the vertex x. A matching M in G is said to be perfect matching

if every vertex in G is M-saturated. A minimum perfect matching in the graph G is a perfect matching with the minimum of total weight $W(M)$. A minimum perfect matching with restriction the crisp graph G can be modeled by 0-1 integer programming: $\min \sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}x_{ij}$, such that $\sum_{i=1}^{n} x_{ij} = 1$, $\sum_{j=1}^{n} x_{ij} = 1$, $w_{ij}x_{ij} \leq c_j, i, j = 1, 2, \ldots, n$, $x_{ij} \in \{0, 1\}, i, j = 1, 2, \ldots, n$. The variable $x_{ij} = 1$ if the edge x_iy_j in the minimum matching M and otherwise, $x_{ij} = 0$. In real life problems, there are indeterminate phenomena in the weight data w_{ij} because the lack of history data, insufficient information, etc. In this paper, we handle it by uncertainty theory. The aim of this research is to formulate perfect matching with restriction in uncertain network by uncertain programming. We regard the weight w_{ij} as uncertain variables ξ_{ij} for $i, j = 1, 2, \ldots, n$. We obtain two models: expected minimum perfect matching model, that is $\min E\left[\sum_{i=1}^{n}\sum_{j=1}^{n} x_{ij}\xi_{ij}\right]$, s.t. $\sum_{i=1}^{n} x_{ij} = 1$, $\sum_{j=1}^{n} x_{ij} = 1$, $\mathcal{M}\{\xi_{ij}x_{ij} \leq c_j\} \geq \alpha$, $x_{ij} \in \{0, 1\}, i, j = 1, 2, \ldots, n$, where $\alpha \in (0, 1)$ is a confidence level, and the second model is α-minimum perfect matching model. We define that a perfect matching M^* is called an α-minimum perfect matching if $\min\{\mathcal{W}|\mathcal{M}\{W(M^*) \leq \mathcal{W}\} \geq \alpha\} \leq \min\{\mathcal{W}|\mathcal{M}\{W(M) \leq \mathcal{W}\} \geq \alpha\}$. Hence, the α-minimum perfect matching model is: $\min \mathcal{W}$, s.t. $\mathcal{M}\left\{\sum_{i=1}^{n}\sum_{j=1}^{n} x_{ij}\xi_{ij} \leq \mathcal{W}\right\} \geq \alpha$, $\sum_{i=1}^{n} x_{ij} = 1$, $\sum_{j=1}^{n} x_{ij} = 1$, $\mathcal{M}\{\xi_{ij}x_{ij} \leq c_j\} \geq \alpha$, $x_{ij} \in \{0, 1\}, i, j = 1, 2, \ldots, n$. Further, we prove that the two models can be transformed into perfect matching with restriction in deterministic forms which can be solved via the judging matrix.

2010 Mathematics Subject Classification: 05C70, 90C27.
Keywords: perfect matching, uncertain network, uncertain programming, expected value model, α-minimum model, judging matrix.

CT-58. L(2,1)-coloring and its related problems on join of certain graphs

Srinivasa Rao Kola, Balakrishna Gudla
National Institute of Technology Karnataka, India
{srinu.iitkgp, gudla.balakrishna}@gmail.com

An $L(2, 1)$-coloring of a simple connected graph G is an assignment f of non-negative integers to the vertices of G such that $|f(u) - f(v)| \geq 2$ if $d(u, v) = 1$ and $|f(u) - f(v)| \geq 1$ if $d(u, v) = 2$ for all $u, v \in V(G)$. The span of f, denoted by span f, is $\max\{f(u) : u \in V(G)\}$. The span or λ-number of G, denoted by $\lambda(G)$, is the smallest k such that there exists an $L(2, 1)$-coloring with span k. An $L(2, 1)$-coloring of G with span $\lambda(G)$ is called a span coloring of G. An $L(2, 1)$-coloring f is said to be irreducible if there exists no $L(2, 1)$-coloring g such that $g(u) \leq f(u)$ for all $u \in V(G)$ and $g(v) < f(v)$ for some $v \in V(G)$. An irreducible span coloring is a span coloring but a span coloring may not be irreducible. If f is an $L(2, 1)$-coloring with span k, then $h \in \{0, 1, 2, \ldots, k\}$ is a hole if there is no $v \in V(G)$ such that $f(v) = h$. The maximum number of holes over all irreducible span colorings of G is denoted by $H_\lambda(G)$. An $L(2, 1)$-coloring with no hole is called as a no-hole $L(2, 1)$-coloring. An irreducible no-hole $L(2, 1)$-coloring is referred as inh-coloring. A graph is said to be inh-colorable if there exists an inh-coloring to

it. The join of two graphs $G_1 = (V_1, E_1)$ and $G_2 = (V_2, E_2)$ is a graph denoted by $G_1 + G_2$ with vertex set $V_1 \cup V_2$ and edge set $E_1 \cup E_2$ together with all the edges that make all the vertices of G_1 adjacent to all the vertices of G_2. In this article, we prove that the λ-number of $G_1 + G_2$ is $V(G_1) + V(G_2)$ for the graphs G_1 and G_2 satisfying a condition. We see that paths of order greater than 3, cycles of order greater than or equal to 5 and some classes of trees satisfy the condition. As a consequence, we show that the join of the above graphs are not inh-colorable and maximum number of holes over all irreducible span colorings is 1.

2010 Mathematics Subject Classification: 05C15, 05C12, 05C76, 05C85.
Keywords: L(2,1)-coloring, irreducible coloring, λ-number, inh-colorable, no-hole coloring.

CT-59. Rainbow connection and strong rainbow connection for $C_n + \overline{K_r}$

Srava Chrisdes Antoro*, Fendy Septyanto, Kiki Ariyanti Sugeng
Universitas Indonesia
{sravachrisdesantoro, fendy.septyanto41, kiki}@sci.ui.ac.id

A rainbow path in an edge coloring graph G is a path whose every edge is colored with a different color. If a nontrivial connected graph G contains a rainbow path for every two vertices in G, then G is rainbow-connected. The rainbow connection number $\mathrm{rc}(G)$ of G is the minimum k colors that used in k-rainbow coloring. If a nontrivial connected graph G contains a rainbow path $u - v$ geodesic for every two vertices in G, then G is strongly rainbow-connected. The strong rainbow connection number $\mathrm{src}(G)$ of G is the minimum k colors that used in k-strongly rainbow coloring. The rainbow connection and strong rainbow connection of graph C_n, $C_n + \overline{K_1}(W_n)$, and $C_n + \overline{K_2}$ have been found. Furthermore, in this paper, the rainbow connection and strong rainbow connection of graph $C_n + \overline{K_r}$ will be determined.

2010 Mathematics Subject Classification: 05C15
Keywords: rainbow coloring, rainbow connection number, strong rainbow coloring, strong rainbow connection number, $C_n + \overline{K_r}$

Poster Session

P-01. The locating-chromatic number for certain amalgamation of stars

Asmiati
Mathematics Department, Lampung University
asmiati308@yahoo.com

Let $\Pi = \{C_1, C_2, \cdots, C_k\}$ be a partition of $V(G)$, where C_i is the set of vertices receiving color i. The color code $c_\Pi(v)$ of a vertex v in G is the ordered k-tuple

$(d(v, C_1), \ldots, d(v, C_k))$ where $(d(v, C_i)$ is the distance of v to C_i. If for any two distinct vertices u, v in G, $c_\Pi(u) \neq c_\Pi(v)$ then c is called a locating-chromatic coloring of G. The locating-chromatic number of graph G, denoted by $\chi_L(G)$, is the smallest k such that G admits a locating coloring with k colors. Amalgamation of stars, denoted $S_{k,m}$ obtained from k copies of stars $k_{1,m}$ by identifying a leaf from each star. In this paper, we discuss the locating-chromatic number for certain amalgamation of stars $nS_{k,m}$, namely, the graph obtained by the concatenation of n graph amalgamation of stars $S_{k,m}$ by linking one leaf from each $S_{k,m}$.

2010 Mathematics Subject Classification: 05C12.
Keywords: graph, tree, locating-chromatic number, amalgamation of stars.

P-02. On the existence of cyclic simple BIBDs

Hsin-Min Sun
Department of Applied Mathematics, National University of Tainan, Taiwan
sunhm@mail.nutn.edu.tw

Let V be a finite set of symbols, and suppose $\mathcal{B}$ is a collection of subsets of V. Then $(V, \mathcal{B})$ is called a (v, k, λ) *BIBD* (*balanced incomplete block design*) if there are parameters v, k, and λ with $v > k \geq 2$ such that the following properties are satisfied: (1) $|V| = v$; (2) every *block* in $\mathcal{B}$ has exactly k symbols; (3) every pair of distinct symbols appears in exactly λ blocks. A design without repeated blocks is called *simple*. A (v, k, λ) BIBD is called *cyclic* if there is an automorphism of order v. For a cyclic BIBD, the set of points can be identified with Z_v. Using Colbourns' recursive method and recent constructions of simple BIBDs from finite fields, we obtain some existence theorems for cyclic simple BIBDs.

Acknowledgments: Research is supported in part by the Taiwan Ministry of Science and Technology grants MOST 103-2115-M-024-002 and MOST 104-2115-M-024-002.

2010 Mathematics Subject Classification: 05B05.
Keywords: balanced incomplete block design, finite field.

P-03. The connected size Ramsey number for matchings versus small stars or cycles

Budi Rahadjeng*, Edy Tri Baskoro, Hilda Assiyatun
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
budi.rahadjeng@students.itb.ac.id, {ebaskoro, hilda}@math.itb.ac.id

The notation $F \to (G, H)$ means that in any red-blue coloring of the edges of F there exists a red copy of G or a blue copy of H in F. The connected size Ramsey number of graphs G and H, denoted by $\hat{r}_c(G, H)$, is the minimum size of a connected graph F satisfying $F \to (G, H)$. For $m \geq 2$, the graph consisting of m independent edges is called a matching and denoted by mK_2. In 1981, Erdös

and Faudree determined the size Ramsey numbers for the pair $(mK_2, K_{1,t})$. They showed that the disconnected graph $mK_{1,t} \to (mK_2, K_{1,t})$ for $t, m \geq 1$. In this paper, we will determine the connected size Ramsey number $\hat{r}_c(nK_2, K_{1,3})$ for $n \geq 4$. We also derive an upper bound on the connected size Ramsey number $\hat{r}_c(nK_2, C_4), n \geq 3$.

2010 Mathematics Subject Classification: 05D10, 05C55.
Keywords: connected size Ramsey number, cycle, matching, star.

P-04. The Harary index of the nanotube $\mathrm{TUC}_4C_8[p, q]$

Sarfraz Ahmad, Fareeha Ambar*
COMSATS Institute of Information Technology, Lahore Campus
sarfrazahmad@ciitlahore.edu.pk, fiamalik7368@hotmail.com

Carbon nanotubes are multi-walled nanostructures made up of pure carbon atoms, found by Iijima in 1991. They have noteworthy mechanical and electronic applications and are used in molecular electronic devices, carbon based nanotips and fiber reinforcement technologies. Due to their applications in nanotechnology, nanotubes are a widely focused subject in the field of solid-state physics. Molecular graph theory is an important branch of mathematical chemistry, extensively used for developing mathemat ical models of the molecular structures to examine their physical, chemical, biological and quantitative structural properties. To study these properties a numerical value must be assigned to the molecular structure. A topological index is a numerical value that depicts the topology and characteristics of the molecular structure and is invariant under automorphism group action. These topological indices can be distance based, degree based or computational based. The problem related to distance in graphs gained the scientists attention both in application and theory. For any two vertices u, v of the graph G, distance is a shortest path between u and v. The oldest distance based topological index is Wiener index which was discovered by Harold Wiener in 1947 while working on the boiling point of paraffin. It is defined as sum of the distance between every two vertices of the graph. The Harary index $H(G)$ is one of the extensively used topological index found separately by Plavsić et al and Ivancic in 1993 with the intuitive expectations that distant sites in a structure should influence each other less than the near sites. The $QSAR$ and $QSPR$ studies have used Harary index to study the decay of interaction between the atoms of the molecule as the distance between them increases. $H(G)$ is defined as the sum of inverse of the distance between every two vertices of the graph. We study nanostructures using the graph theory techniques where vertices and edges of the graph G corresponds to atoms and bonds of the nanostructres respectively. A $\mathrm{TUC}_4C_8[p, q]$ nanotube is a beautiful mathematical structure formed by the combination of octagons and squares. To calculate the Harary index of $\mathrm{TUC}_4C_8[p, q]$ by using its graph is the aim of this paper.

2010 Mathematics Subject Classification: 19K56.

Keywords: topological indices, Harary index, carbon nanotube.

P-05. On the partition dimension of barbell graph, double cones graph, and $K_1 + (P_1 \odot K_n)$

Tri Atmojo Kusmayadi, Sri Kuntari, Dwi Wahyu Hidayat
Department of Mathematics, Sebelas Maret University, Surakarta, Indonesia
{tri.atmojo.kusmayadi, kuntari.uns, dayatdw}@gmail.com

Let G be a connected graph with vertex set $V(G) = \{v_1, v_2, \ldots, v_n\}$ and edge set $E(G) = \{e_1, e_2, \ldots, e_n\}$. The vertex set $V(G)$ is divided into some partitions, which are $S_1, S_2, \ldots, S_k$. For every vertex $v \in V(G)$ and an ordered k-partition $\Pi = S_1, S_2, \ldots, S_k$, the representation v with respect to Π is $r(v|\Pi) = (d(v, S_1), d(v, S_2), \ldots, d(v, S_k))$, where $d(v, S_i)$ represents the distance of the vertex v to each partition in Π. The set Π is said to be resolving partition of G if the representation $r(v|\Pi)$ are distinct, for every vertex v in G. The minimum cardinality of resolving k-partition of $V(G)$ is called the partition dimension of G, denoted by $pd(G)$. In this paper, we determine the partition dimension of barbell $B_{n,n}$ graph, double cones DC_n graph, and $K_1+(P_m \odot K_n)$ graph. Barbell graph $B_{n,n}$ is a graph obtained by two complete graph K_n joined by a bridge. We obtain the partition dimension of barbell graph $B_{n,n}$ are 3 for $n = 3$ and $n + 1$ for $n \geq 4$. Double cones graph DC_n is graph obtained by join of cycle graph C_n with complement of K_2. We obtain the partition dimension of double cones graph DC_n with $n \geq 3$ is $\lceil (6n)^{\frac{1}{3}} \rceil \leq pd(DC_n) \leq 2\lceil n^{\frac{1}{2}} \rceil + 2$. $K_1 + (P_m \odot K_n)$ graph is a graph obtained from K_1 joined by a corona of path and complete graph. We obtain the partition dimension of $K_1 + (P_m \odot K_n)$ graph with $m \geq 2, n \geq 1$ are 3 for $m = 2, n = 1, 2$ and $m + n - 1$ for otherwise.

2010 Mathematics Subject Classification: 05C12.
Keywords: partition dimension, resolving partition, barbell, double cones, $K_1 + (P_m \odot K_n)$.

P-06. The partition dimension of a subdivision of homogeneous firecrackers

Amrullah[1], Edy Tri Baskoro[2]
Saladin Uttunggadewa[2], Rinovia Simanjuntak[2]
[1]Mathematics Department, FKIP Universitas Mataram
[2]Combinatorial Mathematics Research Group, FMIPA ITB
amrullah@unram.ac.id, {ebaskoro,s_uttunggadewa,rino}@math.itb.ac.id

The finding of partition dimension of the graphs is one of the problems of graph theory which is many uncompleted solved. For instance, until now we only know an upper bound of partition dimension of tree. Although several tree classes (for instance caterpillar, homogeneous firecracker) have obtained the partition dimension. In this paper we determine the partition dimension of a subdivision of a tree class, namely a subdivision of homogeneous firecrackers. The subdivision of homogeneous firecracker, $S(G(e; k))$, is a graph obtained from graph G by replaces

an edge e with a $(k+1)$-path where k is a positive integer and $G \simeq F(m,r)$ is a homogeneous firecracker. We show that the partition dimension of $S(G(e;k))$ is equal to the partition dimension of G with $G \simeq F(m,r)$ for almost all values of $m,\ r$ and k.

2010 Mathematics Subject Classification: 05C12.
Keywords: homogeneous firecracker, subdivision, partition dimension, resolving partition.

P-07. Shifted analogues of the tableau switching

Seung-Il Choi[1], Sun-Young Nam*[2], Young-Tak Oh[3]
[1]Seoul National University
[2]Korea Institute for Advanced Study, [3]Sogang University
ignatioschoi@gmail.com, synam@kias.re.kr, ytoh@sogang.ac.kr

We provide two shifted analogues of the tableau switching due to Benkart, Sottile, and Stroomer in 1996; the shifted tableau switching and the modified shifted tableau switching. They are performed by applying a sequence of specially contrived elementary transformations called switches to a pair of shifted Young tableaux sharing a common border, and turn out to have some spectacular properties as the tableau switching has. For instance, they are involutive and behave very nicely with respect to tableaux whose reading words satisfy the lattice property. Exploiting these properties, we give a combinatorial interpretation of Schur P- and Schur Q-function identities. We also demonstrate the relationship between the shifted tableau switching and Worley's shifted J-operation.

2010 Mathematics Subject Classification: 05E05.
Keywords: shifted tableau switching, shifted jeu de taquin, Schur P- and Schur Q-functions, shifted littlewood-Richardson coefficients.

P-08. On metric dimension of edge-corona product of graphs

Rinurwati*[1,2], Herry Suprajitno[1], Slamin[3]
[1]Mathematics Department of Airlangga University, Surabaya, Indonesia
[2]Mathematics Department, ITS Surabaya, Indonesia
[3]Study Program of Information System, Jember University, Indonesia
rinur@matematika.its.ac.id, herry_sam@yahoo.com, slamin@unej.ac.id

For an ordered set $U = \{s_1, s_2, \ldots, s_k\}$ of vertices and a vertex t in a connected graph G, a representation of t with respect to U is an ordered k-tuple $r(t|U) = (d(t,s_1), d(t,s_2), \ldots, d(t,s_k)), d(t,s_i))$ represents a distance between vertices t and s_i. The set U is called a resolving set for G if every vertex of G has a distinct representation. A resolving set containing a minimum number of vertices is called a metric basis for G. Metric dimension of G, denoted by $\dim(G)$, is a number of vertices in a metric basis of G. Given two graphs G, with vertices $s_1, s_2, \ldots, s_{p_1}$ and edges $e_1, e_2, \ldots, e_{q_1}$ and H. The edge-corona $G \Diamond H$ of G and H is defined as the graph obtained by taking q_1 copies of H and for each edge $e_j = s_i s_h$ of G

joining edges between the two end-vertices s_i, s_h of e_j and each vertex j-copy of H. In this paper, we characterise and determine the metric dimension of $G\Diamond H$, for any graph G apart from star and incomplete bipartite graph.

2010 Mathematics Subject Classification: 05C12.
Keywords: resolving set, metric basis, metric dimension, edge-corona.

P-09. On the sigma chromatic number of the join of a finite number of paths and cycles

Maria Czarina T. Lagura*, Agnes D. Garciano, Reginaldo M. Marcelo
Ateneo de Manila University, Philippines
mariaczarinalagura@yahoo.com, {agarciano, rmarcelo}@ateneo.edu

Let G be a simple connected graph and $c : V(G) \to \mathbb{N}$ be a coloring of the vertices in G. For any $v \in V(G)$, let $\sigma(v)$ be the sum of colors of the vertices adjacent to v. Then c is called a sigma coloring of G if for any two adjacent vertices $u, v \in V(G), \sigma(v) \neq \sigma(u)$. The minimum number of colors needed in a sigma coloring of G is the sigma chromatic number of G, denoted by $\sigma(G)$. It has been shown previously that if P_s and P_t are two paths where $5 \leq s \leq t$ then $\sigma(P_s + P_t) = 2$. Moreover, if C_s and C_t are two cycles with orders s and t, respectively, where $4 \leq s \leq t$ and $(s,t) \notin \{(4,4),(5,5),(6,6)\}$, then $\sigma(C_s + C_t) = 2$ if both s and t are even, and $\sigma(C_s + C_t) = 3$ if at least one of s or t is odd. In addition, suppose $s \geq 4$ and t is any positive integer with $(s,t) \neq (4,4)$. Then $\sigma(C_s + P_t) = 2$ if s is even, and $\sigma(C_s + P_t) = 3$ if s is odd. In this paper, we prescribe a sigma coloring of the join of paths and cycles. As a consequence, we will determine the sigma chromatic number of the join of a finite number of paths and cycles. In particular, if $G = P_{n_1} + P_{n_2} + \ldots + P_{n_\ell}$ with $4 \leq n_1 < n_2 < \ldots < n_\ell$ and $n_{i+2} - n_i \geq 4$ where $1 \leq i < i+2 \leq \ell$, then $\sigma(G) = 2$. In addition, if $H = C_{n_1} + C_{n_2} + \ldots + C_{n_\ell}$ with $4 \leq n_1 < n_2 < \ldots < n_\ell$ and $n_{i+2} - n_i \geq 4$ where $1 \leq i < i+2 \leq \ell$, then $\sigma(H) = 2$, if n_i is even for every i, and $\sigma(H) = 3$, if there is an i such that n_i is odd. Now,let $G = \sum_{i=1}^{k} P_{m_i}$ and $H = \sum_{j=1}^{\ell} C_{n_j}$ with $4 \leq m_i < \ldots < m_k$ and $4 \leq n_1 < \ldots < n_\ell$. Assume that $m_{i+1} - m_i \geq 4$, $n_{j+1} - n_j \geq 4$, and $(m_1, n_1) \neq (4,4)$. Then $\sigma(G + H) = 2$, if n_j is even for every j, and $\sigma(G + H) = 3$, if there is a j such that n_j is odd.

2010 Mathematics Subject Classification: 90B99, 05C15, 05C76.
Keywords: path, cycle, join, sigma coloring, sigma chromatic number.

P-10. Spectrum of minimum degrees on t-critically-edge-connected graphs

I Ketut Budayasa[1], Dwi Juniati[2]
[1]Postgraduate Program, Universitas Negeri Surabaya
[2]Department of Mathematics, Universitas Negeri Surabaya
ketutbudayasa@yahoo.com, dwi_juniati@yahoo.com

All graphs consider in this paper are undirected, finite, loopless and have no multiple edges.The edge-connectivity χ'(G) of a graph G is the minimum number of edges of G to be deleted resulting a disconnected graph. A graph G is called *t-critical-edge-connected* if and only if χ'(G)= t and χ'(G-e)< t, for every edge e of G. The set of all t-critical-edge-connected graphs on n vertices is denoted by ζ(n,t). Many extremal results have been establised regarding the graphs in this class. It has been shown that a graph in ζ(n,t) has the edge-connectivity equals to its minimum degree. Since the edge-connectivity of a graph cannot more than its minimum degree, all graphs in ζ(n,t) are having maximum edge-connectivity. In this paper, we consider the problem of determining the number $S_G(n,t)$ of vertices of minimum degree (degree t) in a graph G $\in \zeta$(n,t). Let A(n,t) be denoting the subclass of ζ(n,t) consisting of those graphs in which every edge is incident to at least one vertex of minimum degree. We will prove that if G $\in$ A(n,t), then $S_G(n,t)$ is at least t+1, if t or n is odd and n $\leq$ 2t; t+2, if t and n are even and n $\leq$ 2k; $\lceil((t+1)n)/(2t+1)\rceil$, otherwise. Furthermore, this result is best possible. We will prove that for any integer m, between this bound and n, there exists a graph G $\in \zeta$(n,t) with $S_G(n,t)$ = m. If G $\in \zeta$(n,t) and every block of G is in A(n,t), then a sharp lower bound for $S_G(n,t)$ will be established. Finally, for the case G $\in \zeta$(n,t)\A(n,t), we will prove that $S_G(n,t) \geq$ (t+1) + $(\sqrt{t}-1)^2$.

2010 Mathematics Subject Classification: 05C07, 05C40, 05C75.
Keywords: minimum degree, connected graph, critically-edge-connected graphs.

P-11. The rainbow connection number of certain generalized Jahangir graphs

S. Nabila*, A. N. M. Salman
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
nbl.syahidah@gmail.com, msalman@math.itb.ac.id

Let G be a nontrivial connected graph and $k \in \mathbb{N}$. Define a k-coloring $c : E(G) \to \{1, 2, ..., k\}$ where two adjacent edges may have the same color. A path from u to v, a $u-v$ path, is said a $u-v$ rainbow path if there is no pair of edges in the path with the same color. A rainbow k-coloring is a k-coloring where every pair of vertices u and v in $V(G)$ has a $u-v$ rainbow path. The minimum k for which there exists such a rainbow k-coloring is defined as the rainbow connection number $rc(G)$ of G. Let r and s be two positive integers greater than or equal to 6. A generalized Jahangir graph is a graph obtained from a wheel graph W_r by subdividing each cycle edge $s-1$ times, denoted by $J_{r,s}$. In this paper, we determine

the rainbow connection number for generalized Jahangir graph $J_{r,s}$ where $r \times s$ is an even number.

2010 Mathematics Subject Classification: 05C15, 05C40.
Keywords: edge coloring, generalized Jahangir graph, rainbow coloring, rainbow connection number.

P-12. The rainbow vertex-connection number of star cycle graphs and star mobius ladder graphs

W. B. Ariestha*, A. N. M. Salman
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
ariestha.wbustan@yahoo.co.id, msalman@math.itb.ac.id

A vertex-colored graph $G = (V(G), E(G))$ is said to be rainbow vertex-connected, if for every two vertices u and v in $V(G)$, there exists a u-v path with all internal vertices have distinct colors. The rainbow vertex-connection number of G, denoted by $rvc(G)$, is the smallest number of colors needed to make G rainbow vertex-connected. Let m and n be two integers at least 3, S_m be a star with m vertices, C_n be a cycle with n vertices, and M_n be a mobius ladder with n vertices. A star cycle (S_mC_n) is a graph obtained by embedding a copy of C_n to each pendant of S_m. A star mobius ladder (S_mM_n) is a graph obtained by embedding a copy of M_n to each pendant of S_m. In this paper, we determine the rainbow vertex-connection number of star cycle graphs and star mobius ladder graphs.

2010 Mathematics Subject Classification: 05C15, 05C40.
Keywords: rainbow vertex-coloring, rainbow vertex-connection number, star cycle graph, star mobius ladder graph.

P-13. The rainbow vertex-connection number of some shield graphs

R. Palupi*, A. N. M. Salman
Combinatorial Mathematics Research Group, Institut Teknologi Bandung
ratnaning.palupi@gmail.com, msalman@math.itb.ac.id

Let G be a nontrivial simple connected graph, ab be an edge of G and m be an integer at least 4. A *path* of order m, denoted by P_m, is a graph whose vertices can be labelled $v_1, v_2, ..., v_m$ such that $E(P_m) = \{v_1v_2, v_2v_3, ...v_{m-1}v_m\}$. A G_{ab}^m*-shield* graph, denoted by $P(m, G, ab)$, is a graph obtained by P_m and $m-1$ copies of G such that the ab edge of i-th G embedded to i-th edge of P_m by embedding a to v_i and b to v_{i+1}. A path in a vertex-colored graph is said to be *rainbow-vertex path*, if every internal vertex in the path has different color. A vertex-colored graph is said to be *rainbow vertex-connected*, if for every u and v there exists a $u-v$ rainbow vertex path. The *rainbow vertex-connection number* of G, denoted by $rvc(G)$, is the minimum colors needed to make G rainbow vertex-connected. In this paper, we determine the rainbow vertex-connection number of G_{ab}^m-shield graph for some G i.e. completes, mobius ladders, and wheels.

2010 Mathematics Subject Classification: 05C15, 05C40.
Keywords: complete, mobius ladder, path, rainbow vertex-coloring, rainbow vertex-connection number, shield graph, wheel.

P-14. Properties of antiadjacency eigenvalues of regular and line graphs

Kiki Ariyanti Sugeng
Universitas Indonesia
kiki@sci.ui.ac.id

Let G be a simple and undirected graph with n vertices and m edges. Antiadjacency matrix of G is an $n \times n$ matrix $B = (b_{ij})$ with $b_{ij} = 0$ if there is an edge between vertex i and vertex j and $b_{ij} = 1$ for other cases. Actually an antiadjacency matrix of a graph G is $B = J - A$ where J is a one matrix (all entries are one) and A is an adjacency matrix of the graph G. In this work we show the properties of eigenvalue of antiadjacency matrix for regular graph and line graphs. Moreover, we will show relation between antiadjacency eigenvalues and adjacency eigenvalues of a graph G and give example of spectra of some classes of graphs.

2010 Mathematics Subject Classification: 05C50
Keywords: adjacency matrix, antiadjacency matrix, eigenvalue, linegraph.

P-15. Eigenvalues of adjacency and Laplacian matrices of graph Spl$(G) - E(G)$ for some regular graph G

Wisnu Aribowo*, Kiki Ariyanti Sugeng
Universitas Indonesia
{waribowo, kiki}@sci.ui.ac.id

Let G be a k-regular graph with n vertices and m edges. Define a graph $\mathrm{Spl}(G) - E(G)$ as the graph $\mathrm{Spl}(G)$ without the edges of the initial graph G. The early results of this graph construction are that $\mathrm{Spl}(G) - E(G)$ is bipartite, retains the regularity of G (it remains k-regular), has $2n$ vertices, and $2m$ edges. In this paper, we discuss the relation between adjacency and Laplacian eigenvalues values of graph G and graph $\mathrm{Spl}(G) - E(G)$. The results are as follows, if λ is an adjacency eigenvalue of G, then $\pm\lambda$ is an adjacency eigenvalues of $\mathrm{Spl}(G) - E(G)$—these results also valid for a nonregular graph G, and $k \pm \lambda$ are Laplacian eigenvalues of $\mathrm{Spl}(G) - E(G)$.

2010 Mathematics Subject Classification: 05C50.
Keywords: $\mathrm{Spl}(G) - E(G)$ graphs, eigenvalues, adjacency matrix, Laplacian matrix.

P-16. Closed geodetic numbers of graphs resulting from some graph operations

Imelda S. Aniversario*, Ferdinand P. Jamil
Mindanao State University-Iligan Institute of Technology, Iligan City, Philippines
imeldaaniversario@yahoo.com, ferdinand.jamil@g.msuit.edu.ph

Let G be a connected graph. For $S \subseteq V(G)$, the geodetic closure $I_G[S]$ of S is the set of all vertices on geodesics (shortest paths) between two vertices of S. We select vertices of G sequentially as follows: Select a vertex v_1 and let $S_1 = \{v_1\}$. Select a vertex $v_2 \neq v_1$ and let $S_2 = \{v_1, v_2\}$. Then successively select vertex $v_i \notin I_G[S_{i-1}]$ and let $S_i = \{v_1, v_2, \ldots, v_i\}$. We define the *closed geodetic number* of G, denoted $cgn(G)$, to be the smallest k whose selection of v_k in the given manner yields $I_G[S_k] = V(G)$. In this paper, we determine the closed geodetic numbers of some special graphs and the joins of connected graphs. It also determines the closed geodetic numbers of graphs resulting from a corona and a composition of connected graphs. The idea of closed geodetic number comes from two classes of graphical games called *achievement and avoidance games* presented by Harary in [10]. These games were examined for the geodetic number by Buckley and Harary, and by Necaskova in [11]. A study on closed geodetic numbers is done in [1]. Among the results obtained in [1] is the characterization of connected graphs G for which $cgn(G) = p, p-1$, 2 or 3. It is also shown that for any positive integers k and n for which $4 \leq k \leq \lfloor \frac{n}{2} \rfloor$, there always exists a connected graph G where $|V(G)| = n$, $gn(G) = 4$ and $cgn(G) = k$. And for integers n, m and k with $5 \leq m \leq k$ and $2k - m + 4 \leq n$, there exists a (connected) graph G such that $|V(G)| = n$, $gn(G) = m$ and $cgn(G) = k$ where $gn(G)$ is the geodetic number of graph G.
The closed geodetic number of a graph determines the winner in the achievement game but the loser in the avoidance game subject to the rule on closed geodesic.

2010 Mathematics Subject Classification: 05C12.
Keywords: distance, geodesic, geodetic number, closed geodetic number.

P-17. Eigenvalues of adjacency, antiadjacency, and Laplacian matrices of bracelet$-K_n$ graph

Ermita Rizki Albirri*, Kiki Ariyanti Sugeng
Universitas Indonesia
{mitalbi, kiki}@sci.ui.ac.id

Let G be an undirected simple graph. Adjacency matrix of a graph G, denoted by $(A(G))$, is defined as a matrix which has entry-(i, j) is equal 1 if vertex i and vertex j are adjacent and 0 if otherwise. Let $D(G)$ be the diagonal matrix of vertex degree and $J(G)$ be the matrix which has entry all ones. Laplacian matrix $(L(G))$ can be defined by $L(G) = D(G) - A(G)$. Antiadjacency matrix $B(G)$ is defined as $B(G) = J(G) - A(G)$. This study discusses eigenvalues of adjacency, antiadjacency, and Laplacian matrices of the Bracelet$-K_n$ graph. The results of

this study indicate that the Bracelet$-K_n$ graph for $n \geq 4, n$ even has four different eigenvalues of adjacency, Laplacian and antiadjacency matrices.

2010 Mathematics Subject Classification: 05C50
Keywords: adjacency matrix, Laplacian matrix, antiadjacency matrix, bracelet$-K_n$ graph.

P-18. On the metric dimension of web graph, generalized flower graph and $C_n *_2 K_m$ graph

Dwi Ria Kartika*, Tri Atmojo Kusmayadi
Department of Mathematics, Sebelas Maret University, Surakarta, Indonesia
tikakartika@student.uns.ac.id, tri.atmojo.kusmayadi@gmail.com

Let G be a connected simple graph with vertex set $V(G)$ and edge set $E(G)$. Distance between vertex v_1 and v_2 in G, denoted by $d(v_1, v_2)$ is the length of a shortest $v_1 - v_2$ path. If $W = \{w_1, w_2, w_3, \ldots, w_k\}$ is a finite set of vertices of G and $v \in V(G)$, then the representation of v with respect to W is the ordered k-pair $r(v \mid W) = (d(v, w_1), d(v, w_2), d(v, w_3), \ldots, d(v, w_k))$. The set W is called a resolving set for G if every two vertices of G have distinct representations. The resolving set with a minimum cardinality of $V(G)$ is called a basis for G. The number of vertices in basis for G is called a metric dimension of G, denoted by $dim(G)$. The vertex-amalgamation of a pair of vertex graphs (G, t) and (H, u) is the graph obtained from their disjoint union by merging the vertices t and u. The edge-amalgamation of a pair of edge graphs (G, a) and (H, b) is the graph obtained from their disjoint union by merging the edges a and b. In this paper, we determine the metric dimension of web graph, generalized flower graph and $C_n *_2 K_m$ graph. Web graph W_n for $n \geq 3$ as a generalized prism graph $Y_{n+1,3}$ with the edges of the outer cycle removed. We obtain the metric dimension of web graph are 2 for n odd and 3 for n even. Generalized flower graph with p petals $FL(G, m, n, p)$ as a graph obtained from the generalized web graph $WB(G, m, n)$ by connecting each vertex and the p pendant vertices to the apex with an edge. We obtain the metric dimension of generalized flower with $G \cong C_m$ are 3 for $m = 3, n = 2, 3$; n for $m = 3, n \geq 4$; $2n - 2$ for $m = 4, n \geq 4$; $m + 2n - 5$ for m, n others. $C_n *_2 K_m$ graph is the results of amalgamation edge operations C_n and K_m. We obtain the metric dimension of $C_n *_2 K_m$ graph with $n \geq 3$ is 2 for $m = 2, 3$ and the metric dimension of $C_n *_2 K_m$ graph with $n \geq 3$ is $m - 1$ for $m \geq 3$.

2010 Mathematics Subject Classification: 05C12.
Keywords: metric dimension, resolving set, friendship graph, generalized flower graph, $C_n *_2 K_m$ graph.

P-19. The eccentric digraph of a graph

Eka Ferawati*, Tri Atmojo Kusmayadi
Department of Mathematics, Sebelas Maret University, Surakarta, Indonesia
ekaferawati@student.uns.ac.id, tri.atmojo.kusmayadi@gmail.com

Let G be a graph with vertex set $V(G)$ and edge set $E(G)$. The distance $d(u,v)$ between vertex u and v in G is the length of the shortest path from u to v. The eccentricity of vertex u, $e(u)$ is the maximum distance from u to any other vertices in G. Vertex v is an eccentric vertex of vertex u if $d(u,v) = e(u)$. If there is no path from u to v then $d(u,v) = \infty$. The eccentric digraph $ED(G)$ of a graph G is the digraph having the same vertex set as G and there is an arc from u to v if and only if v is an eccentric vertex of u. In this paper, we determine the eccentric digraph of windmill graph and corona of wheel graph with any graph H. The windmill graph $K_n^{(m)}$ is the graph obtained by taking m copies of the complete graph K_n with a vertex in common. We obtain the eccentric digraph of $K_n^{(m)}$ graph is $K_1 + M$ where M is complete $m-$partite digraph with partitions $V_1, V_2, \ldots, V_m$ and $|V_i| = n-1$ for $i = 1, 2, 3, \ldots, m$. The antiprism graph, denoted by A_n for $n \geq 3$ is a regular graph which has 4 degrees with $2n$ vertices and $4n$ edges. It consists of outer and inner C_n then between two cycles are connected by edge $v_i u_i$ and $v_i u_{1+i(mod\, n)}$ for $i = 1, 2, 3, \ldots, n$. We obtained the eccentric digraph of A_n are $\bigcup_{i=1}^{n} K_2$ for n odd and $T_{2,n-1,n-1}$ for n even. The wheel graph W_n is a graph obtained from a cycle by adding one more vertex u that is adjacent to each of the other vertices. If W_n is a wheel graph of order n then the corona of W_n with any graph H, denoted by $W_n \odot H$ is the graph obtained by taking one copy of W_n and n copies of H and joining the $i-$th vertex of W_n with an edge to every vertex in the $i-$th copy of H. Let $U = \{u_0, u_1, u2, \ldots, u_{n-1}\}$, $W = \{v_1, v_2, \ldots, v_m\}$, $V_i = \{v_1^i, v_2^i, \ldots, v_m^i\}$ for $i \in [0, n-1]$. We obtain the eccentric digraph of $W_n \odot H$ consist of two cases based on the values of n. The eccentric digraph of $W_n \odot H$ for $n = 3$ is $P \cup Q \cup R \cup S$ with P is complete 4$-$partite digraph with partitions W, V_1, V_2, V_3. $Q = u + [\bigcup_{i=0}^{2} V_i]$, $R = U + W$, $T_i = u_i + [\bigcup_{i \neq j}^{2} V_j]$, and $S = \bigcup_{i=0}^{2} T_i$.The eccentric digraph of $W_n \odot H$ for $n > 3$ is $A \cup B \cup C$ with $W' = \{u\} \cup W$, $A = W' + [\bigcup_{i=0}^{n-1} V_i]$, $B = \bigcup_{k \neq (i-1,i,i+1)\, mod\, n}^{n-1} V_i + V_k$, $D_i = u_i + [\bigcup_{k \neq (i-1,i,i+1)\, mod\, n}^{n-1} V_k]$, and $C = \bigcup_{i=0}^{n-1} D_i$.

2010 Mathematics Subject Classification: 05C12.
Keywords: eccentric digraph, eccentricity, windmill graph, $W_n \odot H$.

P-20. Signed product cordial labeling of flower graph $f_{n\times 4}$ with graph operations is duplicating all the edges

Siti Julaeha*, Hadiati
Mathematics Department, State Islamic University Bandung, Indonesia
siti.julaeha83@uinsgd.ac.id, hadiati@gmail.com

A signed product cordial labeling of a graph G' is a vertex labeling $f : V(G') \to \{-1, 1\}$ with induced edge labeling $f^* : E(G') \to \{-1, 1\}$ defined by $f^*(uv) =$

$f(u)f(v)$ if $|v_f(-1) - v_f(1)| \leq 1$ and $|e_f(-1) - e_f(1)| \leq 1$. Where $v_f(-1)$ is the number of vertices labeled with -1, $v_f(1)$ is the number of vertices labeled with 1, $e_f(-1)$ is the number of edges labeled with -1, and $e_f(1)$ is the number of edges labeled with 1. In this paper we determine signed product cordial labeling of flower graph $f_{n\times 4}$ with graph operations is duplicating all the edges.

2010 Mathematics Subject Classification: 05C78.
Keywords: signed product cordial labeling, flower graph, duplication of edges.

P-21. Gray codes inducing complete bipartite graphs

I Nengah Suparta
Depart. of Math. Edu., Universitas Pendidikan Ganesha, Bali, Indonesia
isuparta@yahoo.com

A Gray code of length n is a list of all binary words of length n such that each two successive codewords differ in only one bit position. If the first and the last codewords also share this property, the Gray code is called *cyclic*, otherwise it is called *non-cyclic*. The numbers indicating bit positions in where two successive codewords differ in the list of Gray codes are called *transition numbers*, and the sequence of these all numbers is called the *transition sequence of the Gray code*. In this talk, bit positions of a Gray code of length n will be counted from 1 up until n. If a graph with vertex set $\{1, 2, ..., n\}$ having the property that two vertices i and j are adjacent in the graph if and only if, i and j are consecutive transitions in the transition sequence of the Gray code, then the graph is called *induced by the Gray code*. By using a method for constructing Gray codes, we prove that Gray codes which induce complete bipartite graphs exist.

2010 Mathematics Subject Classification: 05C99, 94B25, 94B60.
Keywords: complete bipartite graph, graph of transition, Gray code, Hamiltonian graph.

P-22. A note on skew-checkered weighing matrices and association schemes

Wai-Keong Kok*, Li-Yin Tan
Depart.of Comp.Sci.& Math., Tunku Abdul Rahman University College, Malaysia
kokwk@acd.acd.tarc.edu.my, tanly@acd.tarc.edu.my

Let n, w be positive integers such that $0 < w \leq n$. A *weighing matrix* $W = W(n, w)$ of order n and weight w is an $n \times n$ $(0, \pm 1)$-matrix satisfying $WW^t = wI_n$. In particular, $W(n, n)$ is called an *Hadamard matrix* and $W(n, n-1)$ is called a *Conference matrix*. We found that the construction of some non-symmetric 4-class association schemes can be reduced to the construction of certain $W(n, w)$ with a special block form called *skew-checkered weighing matrix*, $SCW(n, w)$. In this note, we construct $SCW(n, w)$ and classify them for cases where $n - 4 \leq w \leq n - 2$.

2010 Mathematics Subject Classification: 05B20, 05E30.
Keywords: Hadamard matrix, weighing matrix, association scheme.

P-23. On the rc and src of graphs containting joins with $\overline{K_n}$

Fendy Septyanto*, Kiki Ariyanti Sugeng
Universitas Indonesia
{fendy.septyanto41, kiki}@sci.ui.ac.id

All graphs considered in this paper are finite, simple, and undirected. Let G be a connected graph. A k-coloring (or edge-coloring) is any function $\gamma : E(G) \to \{1, \ldots, k\}$. Such γ is called a *rainbow coloring* if any two vertices of G are connected by a path in G whose edges all receive different colors. Furthermore, γ is called a *strong rainbow coloring* if any two vertices of G are connected by a geodesic in G whose edges all receive different colors. The smallest k for which there is a rainbow k-coloring on G is called the *rainbow connection number* of G, denoted by $\mathrm{rc}(G)$. The smallest k for which there is a strong rainbow k-coloring on G is called the *strong rainbow connection number* of G, denoted by $\mathrm{src}(G)$. The *join* $A+B$ of two graphs A and B with $V(A) \cap V(B) = \emptyset$ is obtained by adding a new edge from each vertex of A to each vertex of B. Note that $A+B$ is always a connected graph, even if A or B are not. Given $m \in \mathbb{N}$ and a graph H with $V(H) = \{h_1, \ldots, h_n\}$, a new grapth $\mathrm{Spl}_m(H)$ is defined as follows. For each $i \in \{1, \ldots, n\}$, there are m new vertices $v_i^1, \ldots, v_i^m$. The vertex-set and edge-set of $\mathrm{Spl}_m(H)$ are $V(\mathrm{Spl}_m(H)) := \cup_{i=1}^n \{h_i, v_i^1, \ldots, v_i^m\}$ and $E(\mathrm{Spl}_m(H)) := E(H) \cup \{v_a^j h_b \,|\, h_a h_b \in E(H), 1 \le j \le m\}$. In this paper we study the rc and src of a graph that contains one or several subgraphs of the form $S + Q$, where $Q \cong \overline{K_n}$ for some $n \in \mathbb{N}$. In particular, we compute $\mathrm{rc}(A + B)$ when B is either $\overline{K_n}$ or a complete multipartite graph. We also prove that $\mathrm{src}(\mathrm{Spl}_m(H)) > \sqrt[\delta(H)]{m}$ for any connected graph H and $m \ge 1$. Furthermore, we compute $\mathrm{rc}(\mathrm{Spl}_m(H))$ whenever $\mathrm{rc}(H) = 2$, $\delta(H) \ge 2$, and H contains a vertex whose neighbors form an independent set.

2010 Mathematics Subject Classification: 05C15, 05C40.
Keywords: edge coloring, geodesic, join, m-splitting, rainbow coloring.

P-24. The characteristic polynomials of the adjacency and anti-adjacency matrices of amalgamation of two complete graphs

Diah Prastiwi*, Kiki Ariyanti Sugeng
Universitas Indonesia
prastiwi10diah@gmail.com, kiki@sci.ui.ac.id

Let G be an undirected and simple graph, with $V(G) = \{x_1, \ldots, x_n\}$. The *adjacency matrix* of G is a (0,1)-matrix $A(G)$ such that the (i, j)-th entry is 1 if and only if x_i and x_j are adjacent in G and 0 for other cases. The *anti-adjacency matrix* of G is a (0,1)-matrix $B(G)$ such that the (i, j)-th entry is 1 if and only if x_i and x_j are not adjacent in G and 0 if and only if x_i and x_j are not adjacent in G. For any $n \times n$ square matrix M, the characteristic polynomial is defined as $\phi(M, x) := \det(xI_n - M)$, where I_n is the $n \times n$ identity matrix. Let $G_{n,m}$ be a graph which is obtained by amalgamation operation of two complete graphs

K_m and K_n. We investigate some spectral properties of $A(G_{n,m})$ and $B(G_{n,m})$. In particular, we prove that $\phi(A(G_{n,m}), x) = (x+1)^{n+m-4}(x^3 + (4-n-m)x^2 + (nm-3n-3m+6)x + 2nm-3n-3m+4)$. We also prove that $\phi(B(G_{n,m}), x) = (x-1)^{n+m-3}(x^2 - 2x + n + m - nm)$.

2010 Mathematics Subject Classification: 05C50.
Keywords: adjacency, anti-adjacency, characteristic polynomial.

P-25. The H-super(anti)magic decompositions of generalized toroidal prism and antiprism graphs

Hendy*, Ahmad Dzulfikar
Universitas Pesantren Tinggi Darul 'Ulum, Indonesia
hendyhendy17@gmail.com, dzulfikara@yahoo.co.id

The concept of an H-magic decomposition of G arises from the combination between graph labeling and graph decompositions. Let H and G be two simple graphs. A family $\mathbb{B} = \{G_1, G_2, ..., G_t\}$ of subgraphs of G is an H-decomposition of G, if all subgraphs are isomorphic to graph H, $E(G_i) \cap E(G_j) = \emptyset$ for $i \neq j$, and $\bigcup_{i=1}^{t} E(G_i) = E(G)$. The graph G is said to be H-magic, if there exists a bijection $f : V(G) \cup E(G) \longrightarrow \{1, 2, ..., |V(G) \cup E(G)|\}$ such that the sum of labels of all edges and vertices of each copy of H in a decomposition is constant. The graph G is said to be $(a, d)H$-anti magic, if there exists a bijection $f : V(G) \cup E(G) \longrightarrow \{1, 2, ..., |V(G) \cup E(G)|\}$ such that the sum of labels of all edges and vertices of each copy of H in a decomposition is element of $\{a, a+d, a+2d, ..., a+(k-1)d\}$. In this paper we show that a family of generalized toroidal prism graphs is $S(C_n)-$ decomposable and a family of generalized toroidal antiprism graphs is C_3-decomposable. Also we show that generalized toroidal prism and antiprism graphs have H-super(anti)magic decompositions, where H isomorf with sun graph $S(C_n)$ and C_3 respectively.

2010 Mathematics Subject Classification: 05C51,05C78.
Keywords: H-(anti)magic decomposition, generalized (toroidal) prism graph , generalized (toroidal) antiprism graph.

P-26. On some properties of a (p, q)-analogues type I and type II of the unified stirling numbers

Omar I. Cauntongan
Mindanao State University-Maigo School of Arts and Trades
o.cauntongan@yahoo.com

In this paper, we used the (p, q)-analogues Type I and type II of the unified Stirling numbers defined by Remmel and Wachs. The following are p, q-analogues of the generalized falling factorial with different motivations:

$$\langle t - r|\gamma\rangle_n = \prod_{j=1}^{n} \left([t]_{p,q} - [r + (j-1)\,\gamma]_{p,q} \right) \quad \text{and}$$

$[t-r|\gamma]_n = \prod_{j=1}^{n}\left([t-r-(j-1)\gamma]_{p,q}\right)$ where $\langle t-r|\gamma\rangle_0 = [t-r|\gamma]_0 = 1$. The type I (p,q)-analogues $S_{n,k}^{1,p,q}(\alpha,\beta,r)$ and $S_{n,k}^{2,p,q}(\alpha,\beta,r)$ are defined for $0 \le k \le n$ via horizontal generating functions:

$$\langle t-r|\alpha\rangle_n = \sum_{k=0}^{n} S_{n,k}^{1,p,q}(\alpha,\beta,r)\langle t|\beta\rangle_k \quad \text{and} \quad \langle t|\beta\rangle_n = \sum_{k=0}^{n} S_{n,k}^{2,p,q}(\alpha,\beta,r)\langle t-r|\alpha\rangle_k .$$

On the other hand type II p,q-analogues $\tilde{S}_{n,k}^{1,p,q}(\alpha,\beta,r)$ and $\tilde{S}_{n,k}^{2,p,q}(\alpha,\beta,r)$ are solution of the following equations:

$$[t-r|\alpha]_n = \sum_{k=0}^{n} \tilde{S}_{n,k}^{1,p,q}(\alpha,\beta,r)[t|\beta]_k \quad \text{and} \quad [t|\beta]_n = \sum_{k=0}^{n} \tilde{S}_{n,k}^{2,p,q}(\alpha,\beta,r)[t-r|\alpha]_k .$$

Both type I and type II p,q-analogues defined with initial values $S_{0,0}^{i,p,q}(\alpha,\beta,r) = \tilde{S}_{0,0}^{i,p,q}(\alpha,\beta,r) = 1$ and $S_{n,k}^{i,p,q}(\alpha,\beta,r) = \tilde{S}_{n,k}^{i,p,q}(\alpha,\beta,r) = 0$ if $k<0$ or $k>n$. These two (p,q)-analogues were used and applied in a combinatorial interpretations in terms of Rook theory and coloring problems. Furthermore, fundamental properties such as vertical and horizontal recurrence relations are established as a consequence of triangular recurrence relations. It has been exhibited that vertical and horizontal recurrence relations have analogous properties to the well-known Chu Shih-Chieh or Hockey-Stick identities of the binomial coefficient. Matrix representation (transform) of both Type I and Type II (p,q)-analogues are defined in order to establish the orthogonality relations, inverse relations and matrix decompositions. Moreover, explicit formula and rational generating function are established.

2010 Mathematics Subject Classification: *11B73, 15A09, 51F20.*
Keywords: stirling number, unified stirling number, q-analogues, p,q-analogues.

P-27. Totally irregular total labeling of some caterpillar graphs

Diari Indriati*[1,2], Widodo[1], Indah E. Wijayanti[1], Kiki A. Sugeng[3]
[1]Faculty of Mathematics and Science, University of Gadjah Mada, Indonesia
[2]Faculty of Mathematics and Science, University of Sebelas Maret, Indonesia
[3]Department of Mathematics and Science, University of Indonesia, Indonesia
diari_indri@yahoo.co.id, {widodo_mathugm, ind_wijayanti}@yahoo.com, kiki@sci.ui.ac.id

Let $G=(V,E)$ or G be a simple, undirected and connected graph with a vertex set V and an edge set E. A total k-labeling $f: V\cup E \to \{1,2,\ldots,k\}$ is defined as a totally irregular total k-labeling if the weights of any two different both vertices and edges are distinct. The definition of vertex weight, for example for vertex x is $wt(x) = f(x) + \sum_{xy\in E} f(xy)$, while the definition of edge weight, for example for edge xy is $wt(xy) = f(x) + f(xy) + f(y)$. A minimum k for which G has a totally irregular total k-labeling is mentioned as a total irregularity strength of graph G and denoted by $\mathrm{ts}(G)$. This paper contains some methods to construct the totally

irregular total k-labelings for some caterpillar graphs and to determine their total irregularity strengths. The results are $ts(S_{n,2,2,m}) = \left\lceil \frac{n+m-1}{2} \right\rceil$ for $n, m \geq 3$, while $ts(S_{n,2,2,2,n}) = \left\lceil \frac{2n-1}{2} \right\rceil$ for $n \geq 4$.

2010 Mathematics Subject Classification: 05C78.
Keywords: total k-labeling, totally irregular total k-labeling, total irregularity strength, caterpillar.

P-28. On the distance two-dominating number of graphs resulting from graph operations

Wicha Dwi Vikade[1], Kosala Dwidja Purnomo[1], Slamin*[2]
[1]Mathematics Department, Universitas Jember, Indonesia
[2]Information System Study Program, Universitas Jember, Indonesia
wicha180790@gmail.com, {kosala.fmipa, slamin}@unej.ac.id

For a graph $G = (V, E)$, a subset $S \subseteq V(G)$ is said to be *dominating set* in G if for each vertex $u \in V(G)$ is either an element of S or is adjacent to an element of S, that is, if for every vertex $u \in V(G)$ there exists a vertex $v \in S$ such that the distance between u and v is at most one. The minimum cardinality of dominating set in G is called *dominating number*. This notion was generalised to *distance two-dominating set* in G which is defined as a subset $S_2 \subseteq V(G)$, where for every vertex $u \in V(G)$ there exists a vertex $w \in S_2$ such that the distance between u and w is at most two. The minimum cardinality of a distance two-dominating set in G is called a *distance two-domination number*. In this paper, we determine the distance two-dominating number of graphs resulting from graphs operations such as corona, amalgamation, shackle and joint.

2010 Mathematics Subject Classification: 05C69.
Keywords: distance two-dominating number, corona, amalgamation, shackle, joint.

P-29. On the rainbow connection number of graphs and its operations

I. H. Agustin*[1], Dafik[2], M. S. Hasan[1], R. N. Darmawan[1], R. Hidayat[1]
[1]Mathematics Dept., University of Jember, Indonesia
[2]Mathematics Edu. Dept., University of Jember, Indonesia
hestyarin@gmail.com, d.dafik@gmail.com, {m.syaiful, nanang.d, r.hidayat}@gmail.com

Let c be a coloring $c : E(G) \to \{1, 2, ..., k\}, k \in \mathrm{N}$ of a nontrivial, finite, simple and undirected connected graph $G = (V, E)$. The adjacent edges may be colored the same colors. A path in an edge colored graph is said to be a rainbow path if no two edges on the path have the same color. An edge colored graph G is rainbow connected if there exists a rainbow $u - v$ path for every two vertices u and v of G. The rainbow connection number of a graph G, denoted by $rc(G)$, is the smallest number of k colors required to edge color the graph such that the graph is rainbow connected. To determine the rainbow connection number for any graph is considered to be a hard problem. Suppose we are given an edge coloring of the graph. How are we convinced whether the colored graph is rainbow connected? Clearly,

if the number of colors is constant then this problem becomes easy. However, if it has an unbounded number of colors, the problem becomes NP-Complete. In this paper, we determine the exact values of rainbow connection number of some special graphs and its operations. The result shows that all exact values of $rc(G)$ studied in this paper attain a lower bound of the rainbow connectivity.

2010 Mathematics Subject Classification: 05C40.
Keywords: rainbow coloring, rainbow connection number, graph operations.

P-30. Construction of super edge antimagicnes of disjoint union of any graph by using a graph coloring technique

A. I. Kristiana[1*], M. Mahmudah[2], Dafik[1], K. D. Purnomo[2]
[1]Mathematics Edu. Dept. University of Jember, Indonesia
[2]Mathematics Dept. University of Jember, Indonesia
{arikakristiana, much.mahmudah}@gmail.com, dafik@unej.ac.id, k.dwipurnomo@gmail.com

Let p, q be an order and a size of a finite, simple and undirected graph $G = (V, E)$. One-to-one mapping f taking the vertices and edges of G onto $\{1, 2, \ldots, p+q\}$ is called an (a, d)-*edge-antimagic total labeling* if the edge-weights $W(uv) = f(u) + f(v) + f(uv)$, where $u, v \in V(G), uv \in E(G)$, form an arithmetic sequence $\{a, a+d, \ldots, a+(q-1)d\}$, where the first term a, $a > 0$ and the common difference d, $d \geq 0$. Such a graph G is called *super* if $f : V(G) \to \{1, 2, \ldots, p\}$. There are a lot of study dealt with antimagicness of graph by using several techniques, in this paper we will study super (a, d)-edge antimagic total of disjoint union of any graphs by using a graph coloring technique as well as provide a new permutation set for a graph to be a SEATL graph.

2010 Mathematics Subject Classification: 05C78.
Keywords: SEATL, disjoint union of any graph, graph coloring.

P-31. Super complete-antimagicness of amalgamation of complete graph

I. H. Agustin*[1], Dafik[2], M. D. Milasari[1]
[1]Mathematics Dept. University of Jember, Indonesia
[2]Mathematics Edu. Dept., University of Jember, Indonesia
hestyarin@gmail.com, d.dafik@unej.ac.id, m.devimilasari@gmail.com

Let $\{H_i\}$ be a finite collection of simple, nontrivial and undirected graphs and let each H_i have a fixed vertex v_j called a terminal. The amalgamation H_i as v_j as a terminal is formed by taking all the H_i's and identifying their terminal. When H_i are all isomorphic graphs, for any positif integer n, we denote such amalgamation by $G = Amal(H, v, n)$, where n denotes the number of copies of H. The graph G is said to be an (a, d)-H-antimagic total graph if there exist a bijective function $f : V(G) \cup E(G) \to \{1, 2, \ldots, |V(G)| + |E(G)|\}$ such that for all subgraphs isomorphic to H, the total H-weights $w(H) = \sum_{v \in V(H)} f(v) + \sum_{e \in E(H)} f(e)$ form an arithmetic sequence $\{a, a+d, a+2d, ..., a+(t-1)d\}$, where

a and d are positive integers and t is the number of all subgraphs isomorphic to H. An (a,d)-H-antimagic total labeling f is called super if the smallest labels appear in the vertices. In this paper, we study a super (a,d)-H antimagic total labeling of $G = Amal(H,v,n)$ and its disjoint union when H is a complete graph.

2010 Mathematics Subject Classification: 05C78.
Keywords: super H-antimagic total graph, amalgamation of graph, complete graph.

P-32. Super total antimagic d-face labeling from corona results of friendship graph with path graph

Vicardy Kempa, Darmaji
Sepuluh Nopember Institute of Technology
vicardykempa@yahoo.co.id, darmaji@matematika.its.ac.id

Super total antimagic d-face labeling is a vertex labeling, edge labeling and face labeling, with weigth of face form the arithmetic sequence, or with additional intent has a super total antimagic d-face labeling have a bijection funcion then weights of face form the an arithmetic sequence. Weight of face that are mean are weight of face for each areas of corona results. In this research, we use graph obtained of corona results of friendship graph with path.

2010 Mathematics Subject Classification: 68R10, 05C78.
Keywords: labeling, super total antimagic labeling, corona, weight of face.

P-33. Bi-resolving graph of cycle-related graphs

Hazrul Iswadi
Universitas Surabaya, Indonesia
hazrul_iswadi@yahoo.com

Let $G(V,E)$ be a simple connected graph. For each $x \in V$, we associate a pair of vectors $S_x = (u,v)$ with respect to $S = \{s_1, s_2, \cdots, s_k\} \subseteq V$, where $u = (d(x,s_1), d(x,s_2), \cdots, d(x,s_k))$ and $v = (\delta(x,s_1), \delta(x,s_2), \cdots, \delta(x,s_k))$, where $d(x,s_i)$ and $\delta(x,s_i)$ respectively denote the lengths of a shortest and longest path between x and s_i. The set S is said to bi-resolving set G if every vertex of G has a distinct pair of vectors. The minimum cardinality of a bi-resolving set is called bi-metric dimension of G. A bi-resolving set S is connected if the subgraph $\langle S \rangle$ induced by S is a nontrivial connected subgraph of G. The connected bi-resolving number is the minimum cardinality of a connected bi-resolving set in a graph G, denoted by $cbr(G)$. A *cbr*-set of G is a connected bi-resolving set with cardinality $cbr(G)$. A connected graph H is a *bi-resolving graph* if there is a graph G with a cbr-set W such that $\langle W \rangle = H$. In this paper we show bi-metric dimension and bi-resolving graph of cycle-related graphs.

2010 Mathematics Subject Classification: 05C69.
Keywords: bi-resolving set, bi-metric dimension, connected bi-resolving number, connected bi-resolving set, bi-resolving graph.

P-34. Local metric dimension of circulant graph

Ruzika Rimadhany*, Darmaji
Institut Teknologi Sepuluh Nopember, Indonesia
ruzika.rimadhany@gmail.com, darmaji@gmail.com

Let G is a connected graph with two vertices u and v. The distance between u and v, denoted by $d(u, v)$ is defined as length of the shortest path from u to v in G. If an ordered set $W = \{w_1, w_2, w_3, \ldots, w_k\}$ of vertices in a connected graph G and a vertex v of $V(G)$, the representation of v with respect to W is $r\langle v \mid W\rangle = \langle d\langle v, w_1\rangle, d\langle v, w_2\rangle, \ldots, d\langle v, w_k\rangle\rangle$. If $r\langle v \mid W\rangle$ for each vertex $v \in V(G)$ is distinct, the set W is a resolving set of G. The resolving set of G with minimum cardinality is a metric dimension and denoted by $dim(G)$. If $r\langle v \mid W\rangle$ for every two adjacent vertices of $V(G)$ which $v \in V(G)$ is distinct then the set W is a local resolving set of G. The local resolving set of G with minimum cardinality is a local metric dimension and denoted by $ldim(G)$. The research to find out local metric dimension of circulant graph.

2010 Mathematics Subject Classification: 05C69, 68R10.
Keywords: metric dimension, local metric dimension, circulant graph.

P-35. Fuzzy autocatalytic set (FACS) and first isomorphism theorem

Rossiana Edhelyn*[1], Tahir Ahmad[2]
[1]Department of Mathematical Sciences, Universiti Teknologi Malaysia
[2]Ibnu Sina Inst. for Fundamental Science Studies, Universiti Teknologi Malaysia
rossianaedhelyn@yahoo.com, tahir@ibnusina.utm.my

In 2005, the new concept of Fuzzy Autocatalytic Set (FACS) born in the requirement to adequately model the clinical waste incineration process. It merged together the concept of fuzzy graph and Autocatalytic Set (ACS). The theory and application of FACS is expanding and blooming until the recent finding of Coordinated FACS of Fuzzy Graph Type-3 established in 2013. The Algebraic structure of FACS has been explored by revealing some properties of its matrices which are adjacency matrix, transition probability matrix, Laplacian matrix, and semi positive definite matrix which leads to Hermitian matrix. Eventually, it is proven that adjacency matrix and transition probability matrix of FACS of Fuzzy Graph Type-3 to be aperiodic, which is not periodic. However, the aperiodic properties related to FACS are not developed yet. In fact, some basic properties of Laplacian matrix indicated that there is a relation between aperiodicity of a graph G and Gershgorin disk. Therefore the proposed study will be on aperiodicity properties, Laplacian matrix, and Gershgorin disk to established the connection between those properties in coordinated FACS of Fuzzy Graph Type-3 and (expectantly) vice versa. Moreover, The set of adjacency matrices of FACS of Fuzzy Graph Type 3 is anticipated to be seen as fuzzy vector space, and the set of adjacency matrices

with euclidean distance of coordinated FACS is also expected to be fuzzy vector space as well. This study will also cover the first isomorphism theorem for FACS.

2010 Mathematics Subject Classification: 15B15, 15A03, 05C72
Keywords: fuzzy autocatalytic set, first isomorphism theorem, fuzzy vector space, euclidean distance.

P-36. The partition dimension of comb product graphs

Novi Mardiana*[1], Suhadi Wido Saputro[2], Faisal[3]
[1]Kopertis Wilayah IV Bandung, Indonesia
[2]Institut Teknologi Bandung, Indonesia
[3]Bina Nusantara University, Indonesia
nov.mardiana@gmail.com, suhadi@math.itb.ac.id, faisal.a135@gmail.com

The concept of partition dimension in graph was introduced in 1998 by Chartrand, et.al. A partition dimension Π of the vertex set of a connected graph G is a *locating partition* of G if every vertex is uniquely determined by its vector of distances to the elements of Π. The *partition dimension* Π of G is the minimum cardinality of a locating partition of G. Observe that to prove that a given partition is locating, it is enough to check that the vectors of distances of every pair of vertices belonging to the same part are different. In this paper, we consider a graph which is obtained by the comb product between two connected graphs. Let o be a vertex of H. The comb product between G and H, denoted by $G \triangleright_o H$, is a graph obtained by taking one copy of G and $|V(G)|$ copies of H and grafting the i-th copy of H at the vertex o to the i-th vertex of G. We give general bounds of $pd(G \triangleright_o H)$ where H is a path. We also give general bounds when H is not path.

2010 Mathematics Subject Classification: 05C12, 05C76.
Keywords: locating set, locating partition,partition dimension, comb product.

S09. Mathematical Aspects of Computer Science, Numerical Analysis and Scientific Computing /Mathematics in Science and Technology

Invited Talks

IT-01. On some variations of the Gärtner-Ellis theorem with applications to information theory

Vincent Tan Yan Fu
Dept.of Elec. and Comp. Eng., Dept.of Math., National University of Singapore
vyftan@gmail.com

I will talk about variations in the Gärtner-Ellis theorem, which is a result in the theory of large deviations. I will only consider "tail" events for the form $X_n > x$. If the sequence of cumulant generating functions of the random variable X_n and the normalizing speed satisfy a certain property, I show that we can prove the lower bounds of the probabilities using ideas from weak convergence, which is a departure from the usual technique based on change-of-measure. Our generalization has applications to erasure decoding in information theory.

2010 Mathematics Subject Classification: 68P30.
Keywords: Gärtner-Ellis theorem, information theory.

IT-02. Operator splitting methods for the phase field equations

Hyun Geun Lee, Jaemin Shin, June-Yub Lee*
Ewha Womans University, Seoul 120-750, Korea
jyllee@ewha.ac.kr

The phase-field method has recently emerged as a powerful computational approach for modeling and predicting mesoscale morphological and microstructure evolution in materials [**?**]. The basic idea in the phase-field model is to introduce conserved or non-conserved order parameters $\phi(\mathbf{x}, t)$ that vary continuously over thin interfacial layers and are mostly uniform in the bulk phases. Numerous numerical algorithms have been developed to improve accuracy and numerical stability of the phase-field method.

In order to remove the time step constraint and guarantee the accuracy in time for a sufficiently large time step, we present a first and a second order semi-analytical Fourier spectral (SAFS) methods for solving the Allen–Cahn equation [**?**]. The core idea of the methods is to decompose the original equation into linear and nonlinear subequations, which have closed-form solutions in the Fourier and physical spaces, respectively.

We also propose a simple and stable second order operator splitting method for Allen–Cahn (AC) type equations with nonlinear source terms.and for solving the phase field crystal equation.We present numerical experiments to show the accuracy and efficiency of the proposed methods.

2010 Mathematics Subject Classification: 37D30.
Keywords: splitting methods, field equations.

IT-03. Optimal hitting set generator and application to pseudorandom generator

Chaoping Xing
Nanyang Technological University
xingcp@ntu.edu.sg

Hitting set generator and pseudorandom generator have found wide applications in derandomized algorithms and complexity theory. We present a construction of optimal hitting set generators through algebraic curves and bilinear map. There are two consequences of this result: (i) we obtain optimal punctured Reed-Muller codes; (ii) we provide a good class of pseudorandom generator.

2010 Mathematics Subject Classification: 11G20, 68W20, 94B27.
Keywords: hitting set, Reed-Muller codes, pseudorandom generator, derandomization.

IT-04. Performance evaluation of some hybrid clustering approaches in analyzing an endemic virus family

A. Bustamam*, H. Muradi, K.R. Adzima, S. Wulandari, G. Suryawati
Department of Mathematics, FMIPA, Universitas Indonesia, Depok 16424
{aalhadi, bhengki.muradi, ckhaola.rachma}@sci.ui.ac.id
{septian.wulandari, eghea.suryawati}@sci.ui.ac.id

Clustering algorithm is one of the powerful, ecient, and critical tools in many areas of comparative biology and bioinformatics. The performance of clustering approaches is very important in order to reveal biologically meaningful and accurate clustering results. In this article we proposed and investigate the performance of some hybrid clustering algorithms by combining some eminent partitional clustering approaches (including Partition Around Medoids (PAM), k-Mean, Self Organizing Maps (SOM) and Fuzzy C-Mean algorithms) with a popular hierarchical approach (single-linkage agglomerative algorithm). These hybrid approaches are applied to analyze and reveal the family of 36 types of Ebola viruses (using NCBI dataset). The clustering process is started with collecting DNA sequences of Ebola viruses from GenBank, then compute the distance matrix using (1) Jukes-Cantor distance approach or (2) n-Mers features extraction approach, as an input data. The process continues with partitional step using PAM, K-Mean, SOM or Fuzzy C-Mean, and then follows by agglomerative step to reveal the nal clusters of Ebola virus family. We compute the Mean Split Silhouette (MSS)value to evaluate the

performance of these hybrid approaches. The results shows that the partitional approaches using n-Mers features extraction model have better performance compare to the Jukes-Cantor distance model. Overall, the Fuzzy C-Mean hybrid approach has better performance compare to other approaches in term of MSS value, cluster results, and computational cost. Moreover, all the hybrid approaches are able to reveal the important and meaningful Ebola virus family.

2010 Mathematics Subject Classification: 62H30, 92B15, 92C20, 92D15, 92D20.
Keywords: hybrid clustering, PAM, k-Mean, SOM, fuzzy C-mean, agglomerative, Ebola virus.

IT-05. A two-level additive Schwarz preconditioner for partition of unity methods

Susanne C. Brenner
Louisiana State University, USA
brenner@math.lsu.edu

We will discuss a two-level additive Schwarz preconditioners for partition of unity methods. Theoretical and numerical results will be presented for second order and fourth order problems.

2010 Mathematics Subject Classification: 65N30.
Keywords: domain decomposition, preconditioner, partition of unity.

IT-06. TBA

Zhou Jian
Tsinghua University, China
zhoujian00@mails.tsinghua.edu

Contributed Talks

CT-01. A study of the diffusive Lotka Volterra system with holling type 2 functional response

Hanz Martin Cheng*, Roden Jason David*
Ateneo de Manila University
hanz_cheng@yahoo.com, rjdavid@ateneo.edu

Recently, numerous models regarding population dynamics have been proposed. In this work, we focus on food chain dynamics. In particular, we start by an outline of the Lotka Volterra Predator Prey system. After which, we extend the predator-prey model by introducing a third species so that the model simulates food chain dynamics. The solutions of these systems will give us the population of a certain species present at a specific time t. By adding a diffusion term, we will also be able to determine how the population diffuses over space as time passes, thus resulting in the study of the Diffusive Lotka Volterra Systems. These phenomena are modelled by systems of nonlinear differential equations.

It is known that it is difficult to find analytic solutions to these types of systems. Because of this, we solve the systems numerically. We use spectral collocation methods, together with Euler methods to approximate the solution of the system.

2010 Mathematics Subject Classification: 65N22, 65N35, 92D25 .
Keywords: Lotka-Volterra, diffusion, food chain dynamics, Spectral Collocation Methods, Euler methods.

CT-02. Chemical reaction network approaches to biochemical systems theory

Carlene Perpetua P. Arceo[1], Editha C. Jose*[2], Angelyn P. Lao[3]
Alberto Marin-Sanguino[4], Eduardo R. Mendoza[5]
[1]Institute of Mathematics, University of the Philippines Diliman, Quezon City
[2]Inst.of Mathematical Sci. and Physics, University of the Philippines Los Baños
[3]Mathematics Department, De la Salle University, Manila, Philippines
[4]Div. of Systems Biotechnology, Technische Universität München, Germany
[5]Fac.of Physics and Center for Nanoscience, Ludwig Maximilian University
cayen@math.up.edu.ph, ecjose1@up.edu.ph, angelyn.lao@dlsu.edu.ph
amsanguino@gmail.com, mendoza@lmu.de

The mathematical and computational modeling of complex biological systems has grown tremendously since the emergence of Systems Biology in 2000. A well-established approach for modeling such systems–pioneered by the microbiologist M. Savageau in 1969–is Biochemical Systems Theory (BST), which uses ODE systems in power law form ([3], [4]). The mathematical theory of chemical reaction networks and kinetic systems, founded also in the late 60's by chemists and chemical engineers and called Chemical Reaction Network Theory (CRNT) has also

been increasingly applied in Systems Biology, particularly by mathematicians and computer scientists (cf. the website of Mathematics of Reaction Networks). A limitation of the current CRNT approach is that most of the propositions assume mass action kinetics (resulting in polynomial dynamical systems), which is based on a "well-mixed, homogeneous" physical environment, a far cry from the crowded, heterogenous intra– and intercellular reality. In our work ([1], [2]), we have begun to explore useful connections between these two mathematical theories by 1) introducing representations of BST models as chemical reaction networks and kinetics systems and 2) extending results of CRNT beyond mass action kinetics to enable the analysis of the structure and qualitative dynamics of BST models. We introduce the concepts of complex factorizability and span surjectivity as generalizations of key properties of mass action kinetics and 1) derive an extension of a "classical" Theorem of Feinberg and Horn (1977) on the coincidence of the kinetic and stoichiometric subspaces to a class of complex factorizable systems and 2) identify the new class of span surjective kinetics, which displays nice structural and dynamic properties and over a large class of networks is non-complex factorizable. Our analysis of 15 BST models shows an unexpected dominance of non-complex factorizable systems and the first 2 "real" biological examples of span-surjective kinetics. Moreover, the analysis shows that the network and kinetic properties of BST models lie outside the current focus of CRNT researchers, and forms an interesting challenge to the community.

2010 Mathematics Subject Classification: 80A30, 92C40, 92C45, 92E20.
Keywords: chemical reaction network, generalized mass action, reactant-determined kinetics, complex factorizable kinetics.

CT-03. Magnetohydrodynamics of unsteady viscous fluid on boundary layer past a sliced sphere

Rahmat Nursalim*, Basuki Widodo, Choirul Imron
Institut Teknologi Sepuluh Nopember
rahmatnursalim@gmail.com, {b_widodo, imron-its}@matematika.its.ac.id

Magnetohydrodynamics (MHD) is important in engineering and industrial fields, because it is useful to develop cheaper and more efficient technology. Some of technologies developed in this study are MHD power generators and accelerators, cooling of nuclear reactor, and crystal growth. In recent years, MHD has been widely studied in many variation of geometry forms such as sphere, porous sphere, flat plate, cylinder, and elliptical cylinder. Sliced sphere is different from studied geometry forms. This paper studies magnetohydrodynamics of unsteady viscous fluid on boundary layer past a sliced sphere. The aim of this study is to develop a mathematical model and to know how the effects of magnetic parameter, slice angle, and observation angle to separation times of flow. The mathematical model is formed by using physics formulas and giving assumptions that there is no magnetic field induction and the voltage on the fluid, and then it is simplified

by boundary layer theory.The simplified mathematical model is solved numerically by using Keller-Box scheme finite difference methods to obtain discrete form. The discrete form is simulated by giving variation of magnetic parameter, slice angle, and observation angle. The simulation results show that separation times of flow increase by increasing magnetic parameter, increasing slice angle, and increasing observation angle.

2010 Mathematics Subject Classification: 76D10, 76M20, 76W05.
Keywords: boundary layer, finite difference methods, magnetohydrodynamics.

CT-04. Modeling and simulation of ocean wave propagation using lattice Boltzmann method

Dian Nuraiman
Department of Mathematics, UIN Sunan Gunung Djati Bandung, Indonesia
Graduate School of Natural Science and Technology, Kanazawa University, Japan
dianuraiman@uinsgd.ac.id

In this paper we present on modeling and simulation of ocean wave propagation from the deep sea to the shoreline using the lattice Boltzmann method (LBM) with the lattice Bhatnagar-Gross-Krook (BGK) scheme. This requires high computational cost for simulation with large domain. We propose to couple the shallow water equations (SWE) model for the deep sea with the incompressible Navier-Stokes equations (NSE) model close to the shoreline in order to reduce the computational cost. We need a cheap model for the deep sea as it represents the largest part of computational domain and a precise model close to the shoreline where waves break and overturn. Additionally, a special method is implemented to treat the complex behaviour of free surface close to the shoreline and the Smagorinsky turbulence model is used to handle turbulent flows. The result shows that the coupled model can reduce the computational cost significantly. However, the coupled model still remains to be verified using benchmark problems.

2010 Mathematics Subject Classification: 76D33
Keywords: ocean wave propagation, lattice Boltzmann method, shallow water equation, incompressible Navier-Stokes equation, free surface treatment.

CT-05. Parameter estimation for S-system models using the bat algorithm

Carlene Pilar-Arceo*[1], Jayson Lucilo[2], Eduardo Mendoza[3]
[1]Institute of Mathematics, University of the Philippines Diliman
[2]College of Science, Bicol University
[3]Physics Department, Ludwig Maximilians University
cayen@math.upd.edu.ph, jalucilo@bicol-u.edu.ph, mendoza@lmu.de

Parameter estimation for models of biochemical systems is computationally expensive due to the non-linearity and high dimensionality of the coupled systems

of ordinary differential equations (ODEs) underlying the models. Hence, it is important to apply novel methods to the problem and assess their performance. This study presents the Bat Algorithm (BA) as a possible tool for parameter estimation in models constructed under the S-system framework, where ODEs are constructed using power law expansions in the variables of the system. BA is a nature-inspired, metaheuristic optimization algorithm recently developed by X. S. Yang. It is based on the echolocation behavior of bats.

Using three S-systems of increasing complexity from the MADMan Benchmarking Framework, the performance of BA is assessed relative to various data sets, initial conditions and noise levels. Simulation results show that BA is capable of giving good estimates to parameters of the models within a reasonable amount of time.

2010 Mathematics Subject Classification: 90C26, 80M50.
Keywords: bat algorithm, parameter estimation, optimization, S-systems.

CT-06. Optimal traffic light control under congestions: case study Universitas Gadjah Mada, Yogyakarta Indonesia

Endrayanto, I.*[1], Nurwantoro, P.[2], Priyambodo, T. K.,[3]
[1]Dept. of Mathematics, Universitas Gadjah Mada, Indonesia
[2]Dept. of Physics, Universitas Gadjah Mada, Indonesia
[3]Dept. of Computer Science & Electronics, Universitas Gadjah Mada, Indonesia
{endrayanto, pekik, mastri}@ugm.ac.id

In this paper, we discuss a mathematical model of network traffic lights as a queue system under traffic congestion. We develop a model that can be used to optimize the travel time of a vehicle in passing some traffic lights. Moreover, using the model of queuing theory, we dynamically optimize the timing of traffic lights control such that the queue will be reduced. As a numerical example, we will apply our model the case in the network of traffic in the campus of Universitas Gadjah Mada, Yogyakarta, Indonesia.

2010 Mathematics Subject Classification: 90B20, 90B22, 90B50, 60K30, 60G99.
Keywords: network queues, traffic congestion, load balancing, optimal traffic light control.

CT-07. Image processing based detection of lung cancer on CT scan images

Bariqi Abdillah, Alhadi Bustamam, Devvi Sarwinda
Department of Mathematics, Universitas Indonesia
bariqi.abdillah@sci.ui.ac.id, alhadi@sci.ui.ac.id, devvi@sci.ui.ac.id

In this paper, we implement and analyze the image processing method for detection of lung cancer. Image processing techniques are widely used in several medical problems for repairs picture in the phase detection and early treatment. This research proposed a detection method of lung cancer using image segmentation. Image segmentation is one of intermediate level processing in image processing.

Marker control and watershed approach are used to segment of CT scan image. Detection phases are followed by image enhancement using Gabor filter, image segmentation, and features extraction. From the experimental results, we found the effectiveness of our approach. The main detected features for accurate images comparison are mask labeling with high accuracy and robust.

2010 Mathematics Subject Classification: 68U10.
Keywords: image processing, image segmentation, CT scan, lung cancer.

CT-08. Hybrid finite element modeling for wave induced oscillation in Pohang new Harbor

Prashant Kumar[1], Kim Kwang Ik[2]
[1]National Institute of Technology Delhi, India
[2]Pohang University of Science and Technology, South Korea
prashantkumar@nitdelhi.ac.in, kimki@postech.ac.kr

Harbors are designed to provide the safe loading, unloading and sheltering for the moored vessels. In seasonal weather conditions, semi-enclosed harbors experienced high resonance, which amplify the surface wave amplitude in the interior of the harbor due to combined effect of wave diffraction and partial reflection from the interior harbor walls. Accurate description of wave induced oscillation in a harbor is required to analyze the impact of high frequency incident wave spectrum. A mathematical model based on Hybrid Finite Element Method (HFEM) is used to formulate the mild slope equation, and analyze the wave characteristic in the realistic harbor. The consideration of partial wave reflection, diffraction, dissipation losses due to absorption and wave absorption due to breakwaters is incorporated in the present model. The present model is validated with well-known existing studies and applied to Pohang New Harbor (PNH) to analyze local resonance, and some tactics such as adding breakwaters and wave absorber are implemented to reduce the wave oscillation. The present model can be used as an efficient engineering tool for designing and planning of the harbor and predicting the wave response.

2010 Mathematics Subject Classification: 65M60, 76B07, 76B15.
Keywords: hybrid finite element method, wave oscillation, pohang new Harbor.

CT-09. On the Drazin-inverse solution of the multilevel Krylov method

Damira Alshimbayeva, Yogi Erlangga
Mathematics, Nazarbayev University, Astana, Kazakhstan
dalshimbayeva@nu.edu.kz, yogi.erlangga@nu.edu.kz

We consider a two-level version of the multilevel Krylov method (MK) *[Erlangga and Nabben, SIAM J. Sci. Comput. 30 (2008), pp. 1572–1595]* for solving linear systems of equations with symmetric positive semidefinite matrix of coefficients $A \in \mathbb{R}^{n\times n}$, of index 1. At an abstract level, the MK method can be viewed as

solving the system $AQ_N\tilde{x} = b$ with a Krylov method, where

$$Q_N = I - Z(Z^TAZ)^{-1}Z^TA + \lambda_n Z(Z^TAZ)^{-1}Z^T,$$

and Z an $n \times r$ full-rank matrix, $r < n$. Among several possible types of solutions, we are particularly interested in the Drazin solution of the system, extracted from a Krylov subspace by DGMRES. Our main result is that, under the nonsingularity assumption of the Z^TAZ that can be practically met, we show that DGMRES converges to the Drazin solution. This solution is different from a solution GMRES produces. This convergence result complements convergence result established for GMRES presented in *[Erlangga and Nabben, 2015]*. Similar results also hold for the left-preconditioned implementation of MK. Numerical results based on diffusion problems with Neumann conditions are presented to show the convergence, which is independent of the gridsize.

2010 Mathematics Subject Classification: 65F08, 65F10.
Keywords: multilevel Krylov, Drazin inverse, DGMRES, Poisson equation.

CT-10. Mathematical epigenetic and phenotypic fitness landscapes: evolutionary effect of pathogens on host traits

Jomar F. Rabajante*[1], Mark Jayson V. Cortez[1], Jerrold M. Tubay[1]
Juancho A. Collera[2], Ariel L. Babierra[1], Editha C. Jose[1]
[1]Inst. of Math. Sciences and Physics, University of the Philippines Los Baños
[2]Dept. of Math. and Comp. Science, University of the Philippines Baguio
jfrabajante@up.edu.ph

The epigenetic landscape illustrates how cells differentiate into different types through the control of gene regulatory networks. Numerous studies have investigated epigenetic gene regulation but there are limited studies on how the epigenetic landscape and the presence of pathogens influence the evolution of host traits.

Here we formulate a multistable decision-switch model involving many possible phenotypes with the antagonistic influence of parasitism. As expected, pathogens can drive dominant or common phenotypes to become inferior, such as through negative frequency-dependent selection. Furthermore, novel predictions of our model show that parasitism can steer the dynamics of phenotype specification from multistable equilibrium convergence to oscillations. This oscillatory behavior could explain pathogen-mediated epimutations and excessive phenotypic plasticity. The Red Queen dynamics also occur in certain parameter space of the model, which demonstrates winnerless cyclic phenotype-switching in hosts and in pathogens.

The results of our simulations elucidate how epigenetic landscape is associated with the phenotypic fitness landscape and how parasitism facilitates non-genetic phenotypic diversity.

2010 Mathematics Subject Classification: 92C15, 92C42, 92D15.
Keywords: parasitism, disease, plasticity, inclusive inheritance, biodiversity.

CT-11. A mathematical model of solid oxide fuel cell fed biomass derived fuel

Sineenart Srimongkol
Department of Mathematics, Faculty of Science, Burapha University
sineenart@buu.ac.th

Biomass derived fuel has been widely used in Thailand. The solid oxide fuel cell can fed variety of fuels. Moreover, the experimental cost of the solid oxide fuel cell is very expensive. Therefore, the mathematical model of solid oxide fuel with biomass derived fuel is crucial. The governing equations for solid oxide fuel are the fully coupled of the current balance equations, the mass transport equations, and the Brinkman equations. Taken into account the biomass derived fuel, the Maxwell-Stefan equations is included more species in the model. The results indicate that the mathematical model is fit with the experimental results.

2010 Mathematics Subject Classification: 58F15, 58F17, 53C35.
Keywords: mathematical model, solid oxide fuel cell, simulation, biomass derived fuel.

CT-12. Retrial G-queue with preemptive resume, server breakdowns and two phase service

Amita Bhagat
Department of Applied Sciences, NCU University, Gurgaon-122017, India
bhagatamita03@gmail.com

We consider a bulk arrival retrial queue equipped with unreliable server. Two types of customers arrive in the system; positive customers and negative customers. The negative customers make the server fail if they find the server in busy state, whereas positive customers are served if the server is idle. The positive customers join the virtual pool of customers called orbit if they find server in busy or breakdown state on their arrival. The server is unreliable which may while any stage of service. The broken down server is then sent for repair as soon as it breakdowns so that the service process may start again. The model under consideration finds application in computer system which is prone to the attack of Malware or virus (negative customers) which on arrival may breakdown the system and stops the normal functioning of the system. Using supplementary variables technique and generating functions, various performance measures like queue length and long run probabilities have been obtained. The numerical results are displayed in the form of graphs and tables.

2010 Mathematics Subject Classification: 60K25, 90B22, 68M20.
Keywords: retrial queue, negative customers, bulk arrival, breakdowns, two phase service, supplementary variable technique.

CT-13. A mathematical model of wolbachia infection to control dengue disease with human response behaviour

A. K. Supriatna*[1], N. Anggriani[1], Melanie[2]
[1]Dept. Mathematics, Padjadjaran University, Jatinangor 45363 Indonesia
[2]Dept. Biology, Padjadjaran University, Jatinangor 45363 Indonesia
a.k.supriatna@unpad.ac.id

The paper discusses a mathematical model of dengue transmission in human and mosquitoes populations. Human population is assumed to have three different classes depending on its epidemiological status, i.e. susceptible, infected, and recovered classes. Meanwhile mosquitoes population has only two classes, i.e. susceptible and infected classes. This is due to the fact that the life time of the mosquitoes is relatively the same as the life time of dengue disease, and hence once a mosquito infected, it status remains unchanged for life. Releasing wolbachia-infected mosquitoes into natural mosquitoes environment has been considered as a potentially effective way in reducing the number of dengue infection in human population. However, we assume that when there is a wolbachia-infected mosquito release program to control the spread of the dengue disease, there will be various human behavior in response to the program. In this paper we investigate the effects of these human population response or behavior into the success/failure of the wolbachia-infected mosquitoes release program in reducing the spread of the disease via the analysis of the corresponding mathematical model. The results in previous model indicate that retention of human population does not affect the final size of dengue infection in human population significantly. This paper generalize the previous model to a more realistic logistic growth of the population.

2010 Mathematics Subject Classification: 92D25, 92D30, 97M60.
Keywords: dengue epidemic model, wolbachia infection, dynamical system, optimal control.

CT-14. Influence of thermal radiation on heat and mass transfer of unsteady MHD free convection flow of Jeffrey fluid with newtonian heating

Nor Athirah Mohd Zin[1*], Ilyas Khan[2], Ahmad Qushairi Mohamad[1]
Sharidan Shafie[1]
[1]Dept. of Math. Science, Faculty of Science, Universiti Teknologi Malaysia
[2]College of Engineering Majmaah University, Majmaah 11952, Saudi Arabia
norathirah24@gmail.com, {ilyaskhanqau, ahmadqushairi91}@yahoo.com, sharidan@utm.my

The combined heat and mass transfer of unsteady magnetohydrodynamic (MHD) free convection flow of Jeffrey fluid past an oscillating vertical plate generated by thermal radiation and Newtonian heating is investigated. The incompressible fluid is electrically conducting in the presence of uniform magnetic field acts in a direction perpendicular to the flow. Mathematical formulation of the considered unsteady two dimensional flow problem is modelled in terms of partial differential equations with some physical conditions. Dimensionless governing equations are

transformed by using an appropriate dimensionless variables and solved analytically by Laplace transform technique. Graphical results for velocity, temperature and concentration fields for various pertinent parameters such as material parameter of Jeffrey fluid λ_1,λ, Newtonian heating parameter ζ, phase angle ω, Grashof number Gr, modified Grashof number Gm, Hartmann number or magnetic parameter Ha, Prandtl number Ha, radiation parameter Rd, Schimdt number Sc and dimensionless time t are displayed and discussed in details. This study shows, the magnetic field resist the fluid flow due to the Lorentz force, whereas the thermal radiation and Newtonian heating parameters leads to the enhancement of velocity and temperature fields. Present results are also compared with the existing published work and an excellent agreement are found.

2010 Mathematics Subject Classification: 76W05, 44A10, 44A35, 76R10, 76A05.
Keywords: Jeffrey fluid, free convection, Newtonian heating, Laplace transform.

CT-15. Unsteady MHD mixed convection flow of rotating second grade fluid with ramped wall temperature

Ahmad Qushairi Mohamad*[1], Ilyas Khan[2], Nor Athirah Mohd Zin[1], Zulkhibri Ismail[1], Sharidan Shafie[1]
[1]Department of Mathematical Sciences, Universiti Teknologi Malaysia
[2]College of Engineering Majmaah University, Majmaah 11952, Saudi Arabia
{ahmadqushairi91, ilyaskhanqau}@yahoo.com, {norathirah24, zulkhibri.ismail}@gmail.com, sharidan@utm.my

This article discussed the effect of ramped wall temperature on rotating magnetohydrodynamics (MHD) second grade fluid in mixed convection flow. The unsteady two dimensional momentum and energy equations of the incompressible fluid are modeled in the form of partial differential equations with initial and oscillating boundary conditions. The governing equations are transformed into non-dimensional equations by using the corresponding non-dimensional variables. The Laplace transform method is applied into non-dimensional equations in order to obtain the analytical solutions of velocity and temperature profiles. Computations are carried out and presented graphically to analyze the effect of second grade fluid parameter, rotation parameter, magnetic parameter, Prandtl number and Grashof number on the profiles. It is found that, when Grashof number increases, the velocity increases in primary and secondary velocities. Both velocities are observed decrease when magnetic and second grade parameters as well as Prandtl number increase. It can be concluded that, the velocity profiles in rotating flow obtained in this study is lower to compare with non-rotating flow. Whereas, the temperature profiles are remain the same for both cases. It is worth to mention that, the exact solutions obtained in this study can be used to check the correctness of the results obtained through numerical schemes.

2010 Mathematics Subject Classification: 35Q79, 76D05, 76R10, 76U05, 76W05.
Keywords: mixed convection, second grade fluid, rotating, mhd, ramped wall.

CT-16. Validation of a hyperbolic system of conservation laws for compressible two-phase flows

Dia Zeidan[1], Eric Goncalvès[2]
[1]German Jordanian University, Amman, Jordan [2]Ensma - Pprime, Poitiers, France
dia.zeidan@gju.edu.jo, eric.goncalves@ensma.fr

This work focuses on compressible two-phase flows which are applicable to a wide range of industrial and environmental settings in which of non-equilibrium phenomena arise. In this study we employ a hyperbolic system of partial differential equations which uses the mixture formulation to describe the solution of the Riemann problem. The model consists of a mixture mass, mixture momentum and a balance law for the relative velocity between the two phases. In order to explore and evaluate the current hyperbolic systems of conservation laws, an extensive mathematical analysis is initiated for the Riemann problem. The system of equations exhibit rich mathematical structures including shock and rarefaction waves solutions. These structures also facilitate the construction of approximate Riemann solvers and locally involve them in the framework of finite volume methods for the complete resolution of the model equations. We then apply and test Godunov type methods on a series of two-phase flow problems. The performed numerical simulations clearly demonstrate that both the model equations and numerical methods are capable for predicting the two-phase flows wave phenomena with a high degree of accuracy and robustness. Comparisons with other models and numerical methods available in the literature show a satisfactory agreement.

2010 Mathematics Subject Classification: 76Txx, 35Lxx, 65Yxx.
Keywords: two-phase flows, hyperbolic PDEs, Riemann problem, Godunov methods.

CT-17. Exact and numerical solutions of the wave equation with fractional time derivative

Thien Binh Nguyen*, Bongsoo Jang
Ulsan National Institute of Science and Technology, Republic of Korea,
thienbinh84@unist.ac.kr, bsjang@unist.ac.kr

In this work, we investigate analytically and numerically the wave equation with a fractional time derivative of order $0 < \alpha \leq 1$ where the fractional derivative is defined in the Caputo sense and there is no diffusion term. That is,

$$\begin{cases} D_t^\alpha u(x,t) + D_x f(u(x,t)) = 0, \quad (x,t) \in \mathbb{R} \times [0,T], \\ u(x,0) = u_0(x), \end{cases} \tag{1}$$

where

$$D_t^\alpha y(t) = \frac{1}{\Gamma(1-\alpha)} \int_0^t (t-s)^{-\alpha} y'(s) ds. \tag{2}$$

We explicitly derive the exact solution of the linear case subject to a class of initial data of polynomial type. Distinct from the classical case where $\alpha = 1$, due to the additional interaction among spatial and temporal terms in the solution where $0 < \alpha < 1$, there exists a damping mechanism in which the solution is smoothed out and reduces the amplitude as it evolves in time. Besides, we observe the presence of a stiff initial layer around $t = 0$ due to the blow-up of the temporal derivative $D_t u(x, t)$ at $t = 0$. The thickness of this layer depends on the fractional order α. This makes numerical approximations of the problem costly in general.

To the best of our knowledge, numerical approximations of Eq. ((1)) are limited. In general, these approximations are obtained from common analytical tools, e.g., the Adomian Decomposition Method (ADM), etc. We show that these methods fail to correctly approximate the exact solution of Eq. ((1)) due to their excessive damping. Instead, we present a robust and efficient first-order scheme with detailed convergence and stability analysis. A CFL-liked condition is derived to guarantee the stability of the new scheme. Numerical results show that our proposed scheme gives more satisfactory numerical solutions than the ADM.

In addition, we also present preliminary results of our method for nonlinear cases where high-gradient regions are expected to occur in the solution, and the results of an in-progress second-order scheme, which is of much more demand in real applications.

2010 Mathematics Subject Classification: *26A33, 35L02, 65L04, 65L12, 65L20.*
Keywords: fractional wave equations, Caputo fractional derivative, exact solutions, damping mechanism, numerical approximations.

CT-18 Asymptotic expansion and numerical simulation for gravity waves in a porous media

I. Magdalena
Faculty of Mathematics and Natural Sciences ITB, Indonesia
ikha.magdalena@math.itb.ac.id

In this paper, we study the propagation of gravity waves pass through an emerged porous media. The governing equations that we used are modified Nonlinear Shallow Water Equations (NSWE) with a friction term of Dupuit-Forchheimer formula. We solve the equations analytically using asymptotic expansion method and numerically using staggered finite volume method. We derived a dispersion relation that holds for gravity waves in an emerged porous structure. This dispersion relation explains diffusive mechanism of the porous structure. Analysis of the dispersion relation shows that amplitude reduction depends on porous medium parameters such as porosity, friction coefficient, length of the structure, and wave frequency. To validate our numerical scheme, we compare the wave reduction amplitude from numerical result with analytical data. Excellent agreement of the comparison is observed. Furthermore, the numerical model is employed to investi-

gate the effectiveness of porous media in dissipating wave energy of an incoming wave.

2010 Mathematics Subject Classification: 76S05, 81U30, 35L02.
Keywords: emerged porous media, asymptotic expansion method, modified NSWE, dispersion relation, staggered finite volume method.

CT-19. Finite element solutions of the RAPM model for risk adjusted option pricing

Dongming Wei, Andrey Pak, Laila Zhexembay
Kazakhstan Nazarbayev University
dongming.wei@nu.edu.kz, Andrey.Pak@nu.edu.kz laila.zhexembay@nu.edu.kz

Nonlinear Black-Scholes equations have been increasingly attracting interest recently, since they provide more accurate values by taking into account more realistic assumptions. The RAPM model is one of the nonlinear Balck Scholes equations which takes into account of the effect of transaction costs. It is known that the RAPM model for risk adjusted option pricing can be transformed into a nonlinear heat equation in $H = S\Gamma$.

In this work, we apply Galerkin approximations to solutions of the Cauchy-Dirichlet problem governed by the heat equation Using an Euler finite difference approximation in time and finite element approximation in space, we analyze the stability and convergence of the numerical method and wealso provide numerical examples.

2010 Mathematics Subject Classification: 78M10.
Keywords: nonlinear Black-Scholes equation, RAPM model, transaction costs, finite element analysis.

CT-20. A preliminary study on time series forecasting electricity load demand using hybrid exponential smoothing-backpropagation model

Winita Sulandari*[1], Subanar[2], Suhartono[3], Suherni[2]
[1]Sebelas Maret University, [2]Gadjah Mada University
[3]Sepuluh Nopember Institute of Technology
winita@mipa.uns.ac.id, subanar@ugm.ac.id, suhartono@statistika.its.ac.id
herni_utami@ugm.ac.id

Short-term electricity load demand forecast is a vital requirements for power systems. This research considers the modification of the state space models for exponential smoothing to handle double seasonal pattern in the electricity demand series. The linear version of Holt-Winter method is extended to accommodate a second seasonal component. In this work, the Fourier series is presented as a means of seasonal extraction. A univariate regression procedure would be applied to estimate the Fourier coefficient. Backpropagation is then implemented to describe the

error of the process. The methodological contribution of this paper is to demonstrate how these methods can be adapted to model the time series data with multiple seasonal pattern and correlated nonstationary error component. The main objectives are to model the level, trend, seasonal and correlated error explicitly and make forecasts of future values. The forecast performance was characterized by root mean square error and mean absolute percentage error. Comparing with other existing models, results showed that the proposed hybrid model generated the most accurate forecast.

2010 Mathematics Subject Classification: 62M10, 82C32, 37M10.
Keywords: load demand, exponential smoothing, backpropagation, hybrid model.

CT-21. A second-order positivity-preserving finite volume scheme for diffusion equations on general meshes

Zhiming Gao*, Jiming Wu
Institute of Applied Physics and Computational Mathematics, China
gao@iapcm.ac.cn, wu_jiming@iapcm.ac.cn

We propose a new positivity-preserving finite volume scheme for the anisotropic diffusion problems on general polygonal meshes based on a new nonlinear two-point flux approximation. The scheme uses both cell-centered and cell-vertex unknowns. The cell-vertex unknowns are treated as auxiliary ones and are computed by two second-order interpolation algorithms. Due to the new nonlinear two-point flux formulation, it is not required to replace the interpolation algorithm with positivity-preserving but usually low-order accurate ones whenever negative interpolation weights occur and, it is also unnecessary to require the decomposition of the co-normal vector to be a convex one. Moreover, the new nonlinear two-point flux approximation has a fixed stencil. These features make our scheme more flexible, easy for implementation and different from other existing nonlinear schemes based on C. Le Potier's two-point flux approximation. The positivity-preserving property of our scheme is proved theoretically and numerical results demonstrate that the scheme has nearly the same convergence rates as compared with other second-order accurate linear schemes, especially on severely distorted meshes.

2010 Mathematics Subject Classification: 65M08, 35R05.
Keywords: diffusion equation, finite volume scheme, positivity-preserving property

CT-22. Magnetic zone model for semi-permeable cracks in piezoelectromagnetic media

Kamlesh Jangid
Deptt. of HEAS (Mathematics), RTU, Kota, India
jangidkamlesh7@gmail.com

Magneto-electro-elastic (MEE) ceramics are a natural extension of electro-elastic (EE) ceramics because of the well-known coupling of electric and magnetic

fields. This MEE is used as sensor, actuators or transducers in high-tech equipments. Piezoelectromagnetic materials are mechanically brittle, while electrically and magnetically ductile in nature. Therefore it is very important to study the fracture behaviour of these materials under the combined action of mechanical stress, electric and magnetic fields.

When electric and magnetic fields are combined with mechanical load it is natural to investigate the possible electromagnetic boundary conditions on crack-faces. As of today following different electromagnetic boundary conditions on the crack rims are prevalent: (a) electrically and magnetically impermeable cracks, (b) electrically impermeable and magnetically permeable crack, (c) electrically permeable and magnetically impermeable crack, (d) electrically and magnetically permeable crack and (e) electrically and magnetically semi-permeable crack. The first four are extreme crack-face boundary conditions, and a lot of crack problems have been done on the basis of aforementioned crack-face boundary conditions, while less work is reported on last two types of crack-face electromagnetic boundary conditions.

Magnetic induction zone model is addressed in the present paper for two semi-permeable equal collinear straight cracks weakening a piezoelectromagnetic plate under combined mode-I magneto-electro-mechanical loads. Stroh's formalism and complex variable technique are employed to obtain the solution. Closed form expressions are derived for induction zone, crack opening displacement, crack potential drop, crack induction drop, field intensity factors, mechanical and total energy release rates. Results obtained are validated with the existing results in the literature. An illustrative numerical case study is presented for $BaTiO_3 - CoFe_2O_4$ ceramic plate. Results are reported graphically, discussed and analyzed. Finally the conclusions are drawn.

2010 Mathematics Subject Classification: 00A71.

Keywords: collinear cracks, piezoelectromagnetic, semi-permeable, Stroh's formalism.

CT-23. A fuzzy approaches to decision making

Sunny Joseph Kalayathankal*[1,2], JohnT Abraham[3]
[1]Bharathiar University, Coimbatore, Tamilnadu, India
[2]Department of Mathematics, K.E.College, Mannanam, Kerala, India
[3]Bharatha Matha College, Thrikkakara, Cochin, Kerala, India
{sunnyjoseph2014, johntabraham}@yahoo.com

Over the last few decades, fuzzy technology (FT) has been increasingly used in decision making. Their computational speed in simulating and forecasting has become highly relevant in real time operations. The theory of fuzzy sets proposed by Zadeh [1965] has attracted wide spread attention in various fields, especially where conventional mathematical techniques are of limited effectiveness, including biological and social sciences, linguistic, psychology, economics, computer and more generally soft sciences. The unique characteristic of fuzzy set theory, in contrast

to classic mathematics, is its operation on various membership functions (MF) instead of the crisp real values of the variables. This heuristic permits fuzzy theory to be a powerful tool whenever it handles imprecise data or ambiguous non - linear relationship between the variables. Out of the several higher order fuzzy sets, intuitionistic fuzzy sets by Atanassov [1985] and Ordered intuitionistic fuzzy sets proposed by Sunny Joseph Kalayathanal et al.,[2010]have been found to be highly useful to deal with vagueness. The importance of membership value varies in different situations. So we need a generalization of intuitionistic fuzzy sets, which is called "ordered intuitionistic fuzzy sets". In this paper, similarity measures between ordered intuitionistic fuzzy sets were developed and applied to multiple attribute decision making (MADM) under fuzzy environment. This paper is organized as follows. The introduction and Model construction are introduced in sections 1 and 2; a numerical example and a short conclusion are given in Section 3 and 4, respectively.

2010 Mathematics Subject Classification: 94D05, 68N30
Keywords: similarity measure, intuitionistic fuzzy set, ordered intuitionistic fuzzy set, decision making.

CT-24. The modified S-iteration process for nonexpansive mappings in CAT(κ) spaces

Prasit Cholamjiak
School of Science, University of Phayao, Thailand
prasitch2008@yahoo.com

In this work, we establish $\triangle$-convergence results of a sequence generated by the modified S-iteration process for two nonexpansive mappings in complete CAT(κ) spaces. Some numerical examples are also provided to compare with the Ishikawa-type iteration process. Our main result extends the corresponding results in the literature.

2010 Mathematics Subject Classification: 47H09, 47H10.
Keywords: $\triangle$-convergence, S-iteration process, nonexpansive mapping, common fixed point.

CT-25. Naive Bayes as opinion classifier to evaluate student's satisfaction based on student sentiment in twitter social media

Fahmi Candra Permana*[1], Yusep Rosmansyah[2], Atje Setiawan Abdullah[1]
[1]Department of Computer Science, Universitas Padjadjaran, Indonesia
fahmicandrap@gmail.com, yusep@stei.itb.ac.id, atjesetiawan@gmail.com

Student's activity on social media can provide implicit knowledge and new perspectives for an educational system. Sentiment analysis is a part of text mining that can help to analyze and classify the opinion data. This research uses text mining and naive Bayes method as opinion classifier, to be used as an alternative

methods in the process of evaluating student's satisfaction for educational institution. Based on test results, this system can determine the opinion classification in Bahasa Indonesia using naive Bayes as opinion classifier with accuracy level of 84% correct, and the comparison between the existing system and the proposed system to evaluate student's satisfaction in learning process, there is only a difference of 16.49.

2010 Mathematics Subject Classification: 68U15, 68U35.

Keywords: text mining, sentiment analysis, social media, naive Bayes.

CT-26. Quasigroup application in constructing 4X4 S-Box

Gigih Bagus Pambekti[1], Sri Rosdiana*[2], Indra Setia Rahmat[2], Caesario O. Kisty[2]
[1]Lembaga Sandi Negara, [2]Sekolah Tinggi Sandi Negara
gigih.bagus@lemsaneg.go.id, {sri.rosdiana, 1211100933, 1312100960}@stsn-nci.ac.id

Cryptography is widely known as one solution to provide data security in respect to the confidentiality and integrity of sensitive data. But, many are facing cryptographic algorithm efficiency problems because cryptographic algorithms place heavy loads on server and significantly slow application response times, especially in new big data deployment. One solution of this problem is the use of Lightweight Cryptography due to its efficiency benefits. S-Box is one of the basic non-linear components in cryptographic algorithm. Among all, 4x4 quasigroup S-box is one kind of S-box which can be used in lightweight cryptography. 4x4 quasigroup S-Box is an S-box formed by applying quasigroup transformation. The research described in this paper is the construction of the 4x4 S-box using e-transformation of quasigroup as well as to know which leader pattern produce the highest number of optimum S-Box and mostly has higher Robustness value. The construction is carried out by implementing six leader patterns used in the four e-transformation rounds of 432 non-linear quasigroups. The results of 4x4 quasigroup S-Box is calculated based on criterias of optimum 4x4 S-Box that has higher Robustness value. Let S as an S-Box. Those criterias are bijective, linearity of 1/4 (Lin(S)=1/4), and differential of (Diff(S)=1/4). The higher Robustness value is, the more difficult differential cryptanalysis is to perform. As many as 6912 4x4 quasigroup S-Boxes are generated for each leader pattern. From all results of the 4x4 quasigroup S-Boxes, it is known that the leader pattern producing S-Box which meet the criteria and all S-Boxes have highest Robustness value are $l_1l_2l_1l_2$ and $l_2l_1l_2l_1$. The number of S-Box which meet the criteria is 18,75 % of the total 5376 different 4x4 quasigroup S-Boxes and the highest Robustness value is 0,75.

2010 Mathematics Subject Classification: 20N05.

Keywords: e-transformation,4x4 quasigroup S-Box, Optimum 4x4 S-Box, Leader pattern.

CT-27. Plane symmetric anisotropy cosmological models in modified gravity

B. Mishra
Dept. of Math., Birla Institute of Technology and Science-Pilani, India
bivudutta@yahoo.com

Anisotropic cosmological models are investigated in the frame work of $f(R)$ gravity in the metric formalism. Plane symmetric models are considered to incorporate anisotropy in the expansion rates along different spatial directions. The anisotropy in expansion rates are assumed to be maintained throughout the cosmic evolution. Two classes of anisotropic cosmological models are constructed by adopting a different method to chose the functional form for $f(R)$. From the constructed models, we obtained the exact forms for the functional $f(R)$. The model parameters are constrained from certain physical basis. The viability of the models are tested through the stability analysis and the conditions of the stability are discussed. In the models, it is shown that, the anisotropic parameter does not affect the power of the Ricci scalar R in the functional $f(R)$. However, the function $f(R)$ is affected by the anisotropic parameter through a multiplicative coefficient term. The analysis shows that, even if, the role of anisotropic is not that much influential in deciding the trend of the models in $f(R)$ gravity, but it has certain importance in providing viable accelerating models in this modified framework.

2010 Mathematics Subject Classification: 83F05.
Keywords: $f(R)$ gravity, Bianchi type I model, constant deceleration parameter.

CT-28. A family of vertex-centered linearity-preserving schemes for diffusion problems on arbitrary polygonal meshes

Jiming Wu
Institute of Applied Physics and Computational Mathematics Beijing
wu_jiming@iapcm.ac.cn

We suggest a family of vertex-centered linearity-preserving finite volume schemes for the heterogeneous anisotropic diffusion equations on general polygonal meshes. The unknowns of these schemes are defined at the mesh vertices, and no auxiliary unknowns are utilized. The schemes are locally conservative with respect to the dual mesh, capture exactly the linear solutions, lead to symmetric positive definite linear systems, and yield a nine-point stencil on structured quadrilateral meshes. The coercivity, stability and H^1 error estimate of the schemes are rigorously analyzed on arbitrary mesh size under some weak geometry assumptions. Also the relation with the finite volume element method is discussed. Finally some numerical tests show the optimal convergence rates for the discrete solution and flux on various mesh types and for various diffusion tensors.

2010 Mathematics Subject Classification: 65M08, 65M12, 35R05.
Keywords: diffusion problems, vertex-centered scheme, polygonal mesh, linearity-preserving discretization.

CT-29. The synchronized traffic light schedule to the railways doorstop

Tomi Tristono*, Setiyo Daru Cahyono, Pradityo Utomo
Universitas Merdeka Madiun
{tomitristono, cahyono.ds, pradityou}@gmail.com

This synchronized traffic lights system has a role to build the traffic management on urban network at an intersection consisting of four arms that has a railway crossing on the south arm. This paper aim proposes the signal model that can adapt to the traffic demand and can synchronize also to the railway doorstop closure that usually longer than a cycle of traffic lights. The system applies a green extension while happening a heavy traffic and a railway doorstop closure. The model applies Place Time Petri Net (PTPN). The method for analysis and verify using: 1. Invariants, 2. Occurrence Graph, and 3. Petri net simulator 2.0 for simulation. The system designs the real-time decision using detectors. The model system verification that applies a green extension design has better performance than regular signal. The simulation result presents that the system can avoid the traffic flow conflict, and the design model implementation test reduces the vehicles congestion also. Place Time Petri Net (PTPN) has presented well the synchronized traffic lights schedule to the railways doorstop closure.

2010 Mathematics Subject Classification: 03B70.
Keywords: synchronized traffic lights, Petri net, intersection, railway doorstop closure.

CT-30. Stability switch and hopf-bifurcation in a delayed intraguild predation model

Julius Fergy T. Rabago*, Juancho A. Collera
Dept. of Math. and Comp. Sci., University of the Philippines Baguio
jfrabago@gmail.com, jacollera@up.edu.ph

Intraguild predation (IGP) – a specific case of omnivory with an inclusion of competition for a shared resource – is known as the most basic system among food webs. The simplest form consists of three species: IG predator, IG prey, and shared prey/resource. This study considers a food web model where the interaction between the basal resource, the IG prey and the IG predator are of Lotka-Volterra type and that there is a duration of τ time units elapses when a shared prey is killed by the IG predator and the moment when the corresponding addition is made to that predator population. Conditions for the existence, stability and bifurcations of all non-negative equilibrium solutions are given using the delay time as a parameter. Numerical experiments are used to illustrate the results presented.

As for the conclusion drawn from the investigation, it was found that the trivial equilibrium solution of the system is always unstable for any delay time $\tau > 0$. This state seems to be unnatural but was seen to be possible due to the structure of the system and to the imposed restrictions on parameters. On the other hand, however, three equilibrium solutions of the system – having at least one of the

three species experience complete extinction – are found to be locally asymptotically stable under some conditions, regardless of the presence of the time delay. Furthermore, it was found that the coexistence among the three species is also attainable under some requirements. Using the Routh-Hurwitz criterion and the well-known Hopf-Bifurcation Theorem, it was shown that a stable positive equilibrium solution may undergoes stability switching as the delay time parameter transgresses a critical value. Numerical experiments showed that though the positive equilibrium becomes unstable, the three species may still persists but their population density will behave in a periodic manner.

2010 Mathematics Subject Classification: 37G15, 39A30, 92D25.
Keywords: Lotka-Volterra model, intraguild predation, Wangersky-Cunnigham type delay, Hopf-Bifurcation.

CT-31. An artificial compressibility method for 3D phase field model and its application to two-phase flows

Abdullah Shah
Dept. of Math., COMSATS Inst. of Information Technology, Islamabad
abdullah_shah@comsats.edu.pk

In this work, a numerical scheme based on artificial compressibility formulation of a phase-field model is developed for simulating three-dimensional two-phase incompressible flows. The coupled nonlinear systems composing of the incompressible Navier-Stokes equations and volume preserving Allen-Cahn type phase equation are recast into conservative forms with source terms, which are suited to implementing high-order schemes (upwind and WENO) developed originally for hyperbolic conservation laws. The Boussinesq approximation is used for buoyancy effects in flows with moderately different densities. The fifth-order weighted essentially non-oscillatory (WENO) scheme is used for discretizing the convective terms while dual-time stepping (DTS) approach is used for obtaining time accuracy at each physical time step. Beam-Warming approximate factorization scheme is utilized so as to obtain block tridiagonal system of equations in each spatial direction which can be solved efficiently with the alternating direction implicit (ADI) algorithm. In spite of being implicit mostly, the numerical scheme still has restriction on physical time step because the source terms are hard to be fully implicit. A stabilization technique is used to enhance the physical time-step. The performance of the numerical method is demonstrated by its application to benchmark viscous two-phase flows problems. Numerical experiments shows that the method allows larger time-steps and smaller η than previous projection methods in literature when computing problems with moving interfaces topological changes. The major limitation of the method is, of course, resolution requirements at small interfacial width η using stationary finite difference grid. In future work, it is intend to use parallel adaptive moving mesh to increase the length scale for phase-field simulation and to go beyond Boussinesq approximation to solve more challenging multi-phase flow

problems with large density and viscosity differences.

2010 Mathematics Subject Classification: 76B45.
Keywords: *incompressible navier-stokes equations, two-phase flow, Phase field model, artificial compressibility method.*

CT-32. The pricing formula for callable European put options

Hsuan-Ku Liu[1], Ting-Pin Wu[2], Jui-Jane Chang[3]
[1]National Taipei University of Education, Taiwan
[2]National Central University, Taiwan, [3]Soochow University, Taiwan
hkliu.nccu@gmail.com, wutingpin@gmail.com, jjane@scu.edu.tw.

A callable option is an option that allows the seller to cancel the option at any point in time by paying a fixed penalty to the holder. A callable option is broadly embedded in a variety of financial products and contracts, such as callable bonds and other structure notes with callable provisions. In practice, the price of a callable option is computed based on numerical methods, such as the Monte Carlo simulation and the binomial tree model. This paper presents an analytical pricing formula of callable options and its accuracy is examined to be significantly accurate as compared with the results computed by the binomial tree model.

2010 Mathematics Subject Classification: 91G20, 35R35, 35K10 .
Keywords: American options, free boundary problem, parabolic equation.

CT-33. A shape calculus based method for a transmission problem with a random interface

Duong T. Pham[1], Alexey Chernov[2], Thanh Tran[3]
[1]Vietnamese German University, [2]Carl von Ossietzky University
[3]The University of New South Wales
duong.pt@vgu.edu.vn, alexey.chernov@uni-oldenburg.de, thanh.tran@unsw.edu.au

The present work is devoted to an approximation of the statistical moments of the solution of a class of elliptic transmission problems in $\mathbb{R}^3$ with uncertainly located transmission interfaces. In this model, the diffusion coefficient has a jump discontinuity across the random transmission interface which models linear diffusion in two different media separated by an uncertain surface. We apply the shape calculus approach to approximate the solution perturbation by the so-called shape derivative. Correspondingly, statistical moments of the solution are approximated by the moments of the shape derivative. We characterize the shape derivative as a solution of a related homogeneous transmission problem with nonzero jump conditions, which is solved by the boundary integral equation method. A rigorous theoretical framework is developed, and the theoretical findings are supported by and illustrated in two particular examples.

2010 Mathematics Subject Classification: 65C99, 65C20, 65L10.

Keywords: shape derivative, transmission problem, random domain, boundary integral equations, spectral discretization, moment equations.

CT-34. Simulation of solid oxide fuel cell with temperature effect

Sineenart Srimongkol
Department of Mathematics, Faculty of Science, Burapha University
sineenart@buu.ac.th

Solid oxide fuel cell can be an alternative energy due to the high performance and its by products are environmental friendly. However, the high temperature operation of the solid oxide fuel cell is the problem. Thus, the study of temperature effect on a planar solid oxide fuel cell is crucial. The governing equations consist of the current balance equations, the mass transport equations, and the Brinkman equations. The effect of temperature from the source term of the current balance equations on the performance of the single cell is calculated using polarization. The results from Comsol Multiphysics indicate that temperature 800 K is the highest current density.

2010 Mathematics Subject Classification: 58F15, 58F17, 53C35.
Keywords: mathematical model, solid oxide fuel cell, simulation.

CT-35. A new geometric method for ordering generalized trapezoidal fuzzy numbers and its application

Handan Akyar
Anadolu University, 26470 Eskisehir, Turkey
hakyar@anadolu.edu.tr

In this study, we present a new geometric method for ordering generalized trapezoidal fuzzy numbers based on the Gergonne point of a triangle, which is the intersection point of the cevians joining the points of tangency of the incircle with the side lines and the opposite vertices of the triangle. Some comparative examples are given to illustrate the advantages of the proposed method. We also give an application of the proposed method to fuzzy risk analysis problem for a production system, where the evaluating values are represented by generalized trapezoidal fuzzy numbers.

2010 Mathematics Subject Classification: 03E72, 91B06, 68T37.
Keywords: fuzzy risk analysis, generalized trapezoidal fuzzy numbers, Gergonne point, ordering fuzzy numbers.

CT-36. Unsteady magnetohydrodynamics viscous fluid with forced convection flow past a sliced sphere

I Gede Eva Purwanta Wijaya*, Basuki Widodo, Chairul Imron
Institut Teknologi Sepuluh Nopember
eva.wijaya55@gmail.com, b_widodo@matematika.its.ac.id, imron-its@matematika.its.ac.id

In this paper, we discuss about the unsteady magnetohydrodynamics viscous fluid flow problem with forced convection pass through a sliced sphere. The flow of viscous fluid pass through a sliced sphere forms a boundary layer. The magnetic field, forced convection, and sliced sphere angle affect the velocity and temperature of the fluid, so the change of velocity and temperature of the fluid is happened. Based on this approach, by using boundary layer equations we form governing equations. The dimensional governing equations are transformed into non-dimensional and similarity equations. The similarity equations are solved numerically using Keller-Box method. We analyze the effect of magnetic parameter, Prandtl number, convection parameters, and the angle of sliced sphere on the velocity and temperature curve. The result of numerical simulation shows that the velocity curve increases when the magnetic parameter is increased, but the fluid velocity curve decreases when the angle of sliced sphere is increased. The temperature curve decreases as the magnetic parameter and Prandtl number are increased, meanwhile the temperature curve increases when the angle of sliced sphere is increased.

2010 Mathematics Subject Classification: 76W05, 76D10, 76R05, 76M20
Keywords: forced convection, Keller-Box method, magnetohydrodynamics, sliced sphere.

CT-37. Modified HPM for linear fractional integro-differential equations of Fredholm-Volterra type

K. M. Hamson*[1], Z. K. Eshkuvatov[1,2], B. M. Taib[1]
[1]Faculty of Science and Technology, Universiti Sains Islam Malaysia (USIM)
[2]Institute for Mathematical Research, Universiti Putra Malaysia (UPM)
khadijah_hamson@yahoo.com, {zainidin, bachok}@usim.edu.my

In this note, we consider linear fractional integro-differential equations of Fredholm-Volterra type with mixed boundary conditions. Modified homotopy perturbation method (HPM) is applied to solve the fractional integro-differential equations of order two. Suitable choices of unknown parameters together with boundary conditions lead the higher accurate approximate solution. The existence and uniqueness solution of the fractional integro-differential equation are obtained. Finally, numerical examples are provided to show the validity and the efficiency of the method presented. Comparisons with other method are also made and results reveal that the proposed method is very efficient and accurate.

2010 Mathematics Subject Classification: 26A33, 34B05.
Keywords: homotopy perturbation method, fractional operator, Fredholm-Volterra integral equation, discretization.

CT-38. On M-unambiguity of Parikh matrices

Wen Chean Teh
School of Mathematical Sciences, Universiti Sains Malaysia
dasmenteh@usm.my

The classical Parikh Theorem states that the Parikh vectors for all words from a regular language form a semilinear set. Parikh matrices are canonical generalization Parikh vectors and this notion was introduced by Mateescu and others in 2001. It has been utilized as a powerful tool for studying subword occurrences. Two words are M-equivalent iff they share the same Parikh matrix. The injectivity problem asks for the characterization of M-equivalence and remains open even for the ternary case.

A word is M-unambiguous iff it is not M-equivalent to another distinct word. Over a ternary ordered alphabet, Serbănută showed that every M-unambiguous word has an M-unambiguous print, where the print of the word $a_1^{n_1}a_2^{n_2}\cdots a_l^{n_l}$ is $a_1a_2\cdots a_l$, provided $a_1, a_2, \ldots, a_l$ are distinct letters and $n_i > 0$ for each $1 \leq i \leq l$. He conjectured that this is true for any ordered alphabet.

In this talk, we will present our findings pertaining to Serbănută's conjecture. Simultaneously, the prevalence of M-unambiguity words will be adressed. For example, assuming Serbănută's conjecture, if Σ is any ordered alphabet, then

$$\lim_{n\to\infty} \frac{\sharp\{\, w \in \Sigma^* \colon w \text{ is } M\text{-unambiguous and } |w| \leq n \,\}}{\sharp\{\, w \in \Sigma^* \colon |w| \leq n \,\}} = 0,$$

where $\sharp A$ denotes the cardinality of A and $|w|$ denotes the length of w.

2010 Mathematics Subject Classification: 68R15, 68Q45, 05A05.
Keywords: Parikh matrices, subword, injectivity problem, print, M-unambiguous.

CT-39. Isometries and binary images of linear block codes over $\mathbb{Z}_{2^r} + u\mathbb{Z}_{2^r}$

Virgilio Sison*, Monica Remillion
University of the Philippines Los Baños
vpsison@up.edu.ph, monicaremillion@gmail.com

Let $\mathbb{F}_2$ be the binary field and $\mathbb{Z}_{2^r}$ the residue class ring of integers modulo 2^r, where r is a positive integer. For the finite 16-element commutative local Frobenius non-chain ring $\mathbb{Z}_4 + u\mathbb{Z}_4$, where u is nilpotent of index 2, two weight functions are considered, namely the Lee weight and the homogeneous weight functions. With the appropriate application of these weights, isometric maps from $\mathbb{Z}_4 + u\mathbb{Z}_4$ to the binary spaces $\mathbb{F}_2^4$ and $\mathbb{F}_2^8$, respectively, are established via the composition of other weight-based isometries. The classical Hamming weight is used on the binary space. The resulting isometries are then applied to linear block codes over $\mathbb{Z}_4 + u\mathbb{Z}_4$ whose images are binary codes of predicted length, which may or may not be linear. Certain lower and upper bounds on the minimum distances of the binary

images are also derived in terms of the parameters of the $\mathbb{Z}_4 + u\mathbb{Z}_4$ codes. Several new codes and their images are constructed as illustrative examples. An analogous procedure is performed successfully on the ring $\mathbb{Z}_8 + u\mathbb{Z}_8$, where $u^2 = 0$, which is a commutative local Frobenius non-chain ring of order 64. It turns out that the method is possible in general for the class of rings $\mathbb{Z}_{2^r} + u\mathbb{Z}_{2^r}$, where $u^2 = 0$, and with cardinality 4^r for any positive integer r, using the generalized Gray map from $\mathbb{Z}_{2^r}$ to $\mathbb{F}_2^{2^{r-1}}$.

2010 Mathematics Subject Classification: 94B05, 94B65, 94B99.
Keywords: Frobenius ring, homogeneous weight, linear block code, binary image.

CT-40. A three-step iterative method free from derivative with sixth-order convergence for solving nonlinear equations

Iin Purnama Edwar*, M. Imran, Leli Deswita
Numerical Computing Group, University of Riau
edwar.iinpurnama@gmail.com, mimran@unri.ac.id, deswital@yahoo.com

This article discusses a derivative-free iterative method to solve a nonlinear equation. The method is derived by approximating derivatives on the method proposed by Han et al. [*Journal of Pure and Applied Mathematics, 2 (2010), 195-203*] using forward difference, divided difference and linear interpolation formulae. We show analytically that the method has sixth-order convergence. Numerical experiments show that the new method is comparable with the other sixth-order methods for some examples considered.

2010 Mathematics Subject Classification: 65H05.
Keywords: forward difference, divided difference, linear interpolation, derivative-free method, iterative method, order of convergence

CT-41 A novel differential evolution algorithm and its application to molecular potential energy problem

Pooja, Praveena Chaturvedi
Gurukula Kangri Vishwavidyalaya, Haridwar, India
mcapooja.singh2007@gmail.com, praveena_c1@rediffmail.com

Differential Evolution (DE) algorithms are known as simple, effective and highly efficient for solving global optimization problems. In the current study, a novel version of DE, named as NDE, is proposed with two enhancements: (1) self- adaptive control parameter; (2) single population structure. These concepts are used to improve the performance of DE without compromising on quality of the solution. Self- adaptive control parameters are used to get good quality solution and single population structure helps in faster convergence as reducing the memory and computational efforts. Their combined effect balances the exploitation and exploration capabilities of DE. The efficiency of the resultant algorithm

is validated with a set of benchmark test functions taken from literature and a real time molecular potential energy problem. The Numerical results pointed out that the proposed NDE algorithm helps in formulating a better trade-off between convergence rate and efficiency.

2010 Mathematics Subject Classification: 34A60.

Keywords: differential evolution, control parameters, population structure, molecular potential energy problem

CT-42. On the design of Hennon map based on true random number generators

Magfirawaty*[1], Suryadi[2], Kalamullah Ramli[1]
[1]Dept. Electrical of Engineering, Universitas Indonesia
[2]Dept.of Mathemathics, Fac.of Math. and Natural Sciences, Universitas Indonesia
magfirawaty@ui.ac.id, yadi.mt@sci.ui.ac.id, k.ramli@ee.ui.ac.id

Key sequence is one of the main elements in the cryptosystem. True Random Number Generators (TRNG) method is one of the approachs to generate the key sequence. This method utilizes the physical phenomenon of a certain hardware to generate series of the random numbers. The randomness source of the TRNG can be devided into three main groups, electrical noise based, jitter based and chaos based. The chaos based utilizes a non-linear dynamic system (continuous time or discrete time) as an entropy source. In this study, we designed a random number generators based on discrete time chaotic system, which are simulated by LabView and used the Hennon map as a chaotic system. The output of Hennon map is processed by a mathematical model. Furthermore, we used logical XOR process as a harvester method to obtain the series of random bits, and used statistical test to determine the randomness of the produced bit series.

2010 Mathematics Subject Classification: 94A60, 14G50

Keywords: randomness, random number generators, chaos, chaotic system, entropy source, Hennon map.

CT-43. Differential evolution-simulated annealing for multiple sequence alignment

Rizavel Addawe*[1], Joel Addawe[1], Joselito Magadia[2]
[1]University of the Philippines Baguio, [2]University of the Philippines Diliman
{rcaddawe, jmaddawe, jcmagadia}@up.edu.ph

Multiple sequence alignments (MSA) are commonly used approaches in the analysis of molecular evolution and sequence structure relationships. In this paper, we propose Differential Evolution - Simulated Annealing (DESA), a novel hybrid optimization algorithm for optimizing multiple sequence alignments (MSAs) based on structural informationa and non-gaps percentage. DESA is a robust algorithm characterized by self-organization, mutation, crossover, and SA-like selection

scheme of the strategy parameters. Here, the MSA problem is treated as a multi-objective optimization problem of the hybrid evolutionary algorithm, DESA. Thus, we name the algorithm as DESA-MSA. Selected sequences and alignments were used to evaluate the performance of DESA-MSA using different indel sizes and sequence lengths. The results so far obtained by the proposed hybrid algorithm are reported and discussed in this paper.

2010 Mathematics Subject Classification: 65C60, 68U20, 65C50.
Keywords: differential evolution, simulated annealing, multiple-objective optimization, multiple sequence alignment.

CT-44. A moving least squares method for X-ray image processing

Yeon Ju Lee
Department of Mathematics, Korea University Sejong Campus, Sejong, S. Korea
leeyeonju08@korea.ac.kr

In this talk, we introduce X-ray image processing and a moving least squares (MLS) based X-ray image de-noising method. The MLS model has shown good performance for interpolation based image processing such as image zooming and superresolution. Normally, the MLS model seeks to find a solution in closed form, which is often the case with methods in the least squares framework. In this study, the least squares based method is adapted with the regularization term of the total variation minimizing for the de-noising problem.

2010 Mathematics Subject Classification: 93E24, 97N50.
Keywords: moving least squares, de-noising, X-ray image.

CT-45. Magnetohydrodynamic (MHD) unsteady nano fluid on the flowing boundary layer past a sliced sphere

Yunita Nur Afifah*, Basuki Widodo, Chairul Imron
Institut Teknologi Sepuluh Nopember
yunita14@mhs.matematika.its.ac.id, {b_widodo, imron-its}@matematika.its.ac.id

Magnetohydrodynamics (MHD) is a study of the movement of fluid flow that can conduct electricity (electric conduction) affected by magnetic fields. This paper discusses magnetohydrodynamics (MHD) of unsteady nano fluid on boundary layer flows past a sliced sphere. The nano fluid flow which is influenced by the magnetic field evoke boundary layer. The boundary layer form a dimensional governing equation. After that transformed into non-dimensional and then transformed into the non-similar form. The non-similar form are solved numerically by using finite difference method with Keller-Box scheme. The results of numerical solution show that the slice angle and the nanoparticle volume fraction increase so the velocity profiles decreases but when the magnetic parameter increases so the velocity profiles increases.

2010 Mathematics Subject Classification: 76W05, 82D80, 76D10, 76M20.
Keywords: magnetohydrodynamic, nano fluid, boundary layer, finite difference method.

CT-46. Initial unsteady free convective flow past in an infinite vertical plate with radiation and mass transfer effects

Aiyub Khan
Dept. of Mathematics & Statistics, Jai Narain Vyas University, Jodhpur, India
draiyubkhan@gmail.com

An exact solution and analysis of an initial unsteady two dimensional free convection flow, heat and mass transfer in presence of thermal radiation along an infinite fixed vertical plate when the plate temperature is instantaneously raised, is presented. The fluid considered is a gray, absorbing emitting radiation but a non-scattering medium. Three cases have been discussed, in particular, namely, (i) When, the plate temperature is instantaneously raised to a higher constant value, (ii) When, the plate temperature varies linearly with time and (iii) When, the plate temperature varies non-linearly with time. A close form general solution for all the cases have been obtained in terms of repeated integrals of error functions. In two particular cases, the solutions in terms of the repeated integrals of error function have been further simplified to forms containing only error functions. It is observed that for an increase in radiation parameter N or a decrease in the Grashof number Gr or Gm, there is a fall in the velocity or temperature, but compared to no radiation case or no diffusing species, there is a rise in the velocity and temperature of the fluid.

2010 Mathematics Subject Classification: 76D10, 76R10, 35Q79.
Keywords: mass transfer, free convection, thermal radiation, heat transfer.

CT-47. g-jitter induced mixed convection flow of Jeffrey fluid past an inclined stretching sheet

Noraihan Afiqah Rawi*, Mohd Rijal Ilias, Zaiton Mat Isa, Sharidan Shafie
Dept. of Mathematical Sciences, Universiti Teknologi Malaysia
nafiqah38@gmail.com, rijal_rs@hotmail.com, zaitonmi@utm.my, sharidan@utm.my

This paper studies the effect of g-jitter on mixed convection flow of Jeffrey fluid past an inclined stretching surface. The velocity and temperature of the sheet are assumed to vary linearly with x, where x is the distance along the sheet. The governing two-dimensional partial differential equation of the incompressible fluid is transformed into non-dimensional form by using an appropriate non-dimensional variables. The resulting non-similar boundary layer equations are solved numerically using an implicit finite-difference scheme known as Keller-box method. The numerical results of surface shear stress in terms of skin friction coefficient and the heat transfer coefficient in terms of local Nusselt number as well as velocity and temperature profiles are obtained and graphically presented. The effects of

the amplitude of modulation, frequency of oscillation, ratio of relaxation to retardation times, and Deborah number on fluid flow are discussed in detail. Results show that, the effect of Deborah number gives rise to the skin friction and heat transfer coefficients but produce an opposite behaviour with the influenced of the ratio of relaxation to retardation times. Meanwhile, with the existence of g-jitter, a significant effect on the variation of skin friction and heat transfer coefficients are observed. The result obtained are compared with an appropriate published results and shows an excellent agreement. It is worth to mention that, this study should be helpful in understanding the g-jitter effect on the fluid flow behaviour especially on the non-Newtonian Jeffrey fluid.

2010 Mathematics Subject Classification: 76A05, 76E06, 76M20
Keywords: g-Jitter, mixed convection, Jeffrey fluid, Keller-box, inclined stretching sheet.

CT-48. Numerical computation in solving the exterior Riemann-Hilbert problem on simply connected regions

Ummu Tasnim Husin*[1], Ali Hassan Mohamed Murid[1,2]
Mukhiddin Ishkobilovich Muminov[1]
[1]Dept. of Mathematical Sciences, Fac. of Science, Universiti Teknologi Malaysia
[2]UTM Centre for Industrial and Appl. Math. Universiti Teknologi Malaysia
ummu.husin@gmail.com, alihassan@utm.my, mukhiddin@utm.my

The solvability of Riemann-Hilbert problem (RHP) is subject to the value of κ, which is defined as the index of RHP. The significant classification of κ is categorized into two cases; κ is a non-positive number and κ is a positive number. It has been discussed in literatures that the exterior (interior) RHP is absolutely solvable for positive κ (non-positive κ). This paper presents a new Fredholm integral equation of a second kind associated to the exterior RHP for both cases of κ. Only continuous kernel is involved in formulating the integral equation, and it is known as the generalized Neumann kernel. The proof on the equivalence of the exterior RHP and the integral equation is also given. Some numerical examples are included to demonstrate that the new proposed Fredholm integral equation solves the exterior RHP effectively on simply connected regions with smooth boundaries.

2010 Mathematics Subject Classification: 30E25, 45B05.
Keywords: Riemann-Hilbert problem, integral equation, generalized Neumann kernel.

CT-49. Magnetohydrodynamics of unsteady micropolar fluid on boundary layer flow past a sliced sphere

Rita Ayu Ningtyas*, Basuki Widodo, Choirul Imron
Institut Teknologi Sepuluh Nopember
ritaayu777@gmail.com, b_widodo@matematika.its.ac.id, imron-its@matematika.its.ac.id

This paper studies about magnetohydrodynamics (MHD) of unsteady micropolar fluid on boundary layer flow past a sliced sphere. Study about boundary

layer can be directed to reduce the negative effects caused by fluid flow across the surface of the object to optimize its performance. The boundary layer is a layer that is formed close to surface of object when fluid past the object caused by the friction factor, and the viscosity of the fluid. This study focus in the stagnation point. The assumptions of the construction governing dimensional equation that the fluid micropolar are incompressible and there is no electrical voltage in the fluid flow. Governing dimensional equation that has been obtained is converted into a non-dimensional equations with variables that substituted for non – dimensional. Furthermore, it is reduced to non-linear differential equations. These equations are solved by using finite difference numerical method with Keller-box scheme. Velocity profiles and micro rotation profile influence by magnetic parameter and micro polar parameter. The results show that the slice angle affects the velocity profile and characteristic micro rotation profile so the velocity increase so does the micro rotation when the magnetic parameter and micro polar parameter increase.

2010 Mathematics Subject Classification: 76A05, 76M20, 76W05.

Keywords: boundary layer, Keller-box, magnetohydrodynamics, micro polar fluid, unsteady.

CT-50. Non-negative matrix factorization as a robust feature selection method for classification of dementia with MRI data

Devvi Sarwinda, Gianinna Ardaneswari*, Alhadi Bustamam
Department of Mathematics, Universitas Indonesia
devvi@sci.ui.ac.id, ninna@sci.ui.ac.id, alhadi@sci.ui.ac.id

This paper investigates applications of non-negative matrix factorization as feature selection method to select the features from gray level co-occurrence matrix. The proposed approach is used to classification of dementia using MRI data. In this study, texture analysis using gray level co-occurrence matrix is done to feature extraction.From processing of MRI data, we found nine features from gray level co-occurrence matrix. Non-negative matrix factorization selected three features that influence of all features produced by feature extractions. A support vector machines (SVM) classifier is adapted to classify dementia, i.e. Alzheimer's disease, Mild Cognitive Impairment (MCI) and normal control. The experimental results show that non-negative factorization as feature selection method was able to achieve an accuracy of 96.4% for classification of Alzheimer's and normal control. The proposed method also compared with other features selection methods i.e. Principal Component Analysis (PCA) and Independent Component Analysis (ICA) show that the results of our approach are better.

2010 Mathematics Subject Classification: 15A23.

Keywords: non-negative matrix factorization, features selection, gray level co-occurrence matrix, Magnetic Resonance Images (MRI).

CT-51. Dynamic microhabitat locality allows multi-species coexistence in a lattice Lotka-Volterra model of terrestrial plant communities

Jerrold M. Tubay*[1], Jin Yoshimura[2]
[1]Math. Div., Inst. of Math. Sci. and Physics, Univ. of the Philippines Los Banos
[2]Dept. of Mathematical and Systems Engineering, Shizuoka University, Japan
jmtubay@up.edu.ph, yoshimura.jin@shizuoka.ac.jp

Micro-environmental variations have been suggested by Tilman many years ago as being responsible for the diversity of tree species in temperate forests.This has been verified through a modified lattice Lotka-Volterra simulation model that incorporates minute differences in specific microhabitat which is applicable for any ecosystem involving sessile organisms. However, due to the rapid global change in climate, a dynamic microhabitat locality is a more convincing element in a study of coexistence of a dynamical system involving plants and other sessile organisms. Here, a modified lattice Lotka-Volterra simulation model, is built to show that microhabitat locality promotes species coexistence even if the minute species- and spatial-differences changes with time.

2010 Mathematics Subject Classification: 37M05, 65C05, 68U20.
Keywords: lattice Lotka-Volterra, microhabitat locality, Monte Carlo simulation, coexistence.

CT-52. Collision attack against Tav-128 hash function

Fajar Hariyanto*, Bety Hayat Susanti
Sekolah Tinggi Sandi Negara
harifajar1994@gmail.com, bety.hayat@mail.lemsaneg.go.id

Tav-128 is a hash function which is designed for Radio Frequency Identification (RFID) authentication protocol. Tav-128 is expected to be a secure hash function cryptographically which meets collision resistance properties. In this research, a collision attack is done to prove whether Tav-128 is a collision resistant hash function. From the results, we see that there are pairs of collided input for every used internal state value. It means that Tav-128 is not a collision resistant hash function.

2010 Mathematics Subject Classification: 94460,14G50.
Keywords: collision attack, collision resistant, hash function, Tav-128.

CT-53. A survey on solution of minimum spanning tree using soft computing-based algorithm and its applications on logistic problems

Shinta Tri Kismanti*, Imam Mukhlash
Mathematics Department, Institut Tehnologi Sepuluh Nopember, Surabaya
{kismanti88, imammukhlash}@gmail.com

Network optimization problem is finding the least valueat a network condition. One of network optimization problem is minimum spanning tree (MST). MST

problem aims to connect all nodes in the network so that total of branches length can be minimized. In this paper, we discussed about the review of research enhancement of solution of MST using soft computing-approach, and its application on logistic system. In general, the solution of MST can be done exact method and heuristic method.

The Solution of MST using Classical Method and Soft Computing Algorithm

The MST problem solving can be implemented by using exact method and heuristic method. Exact methods use mathematical computation which usually used to solve MST problem such as Prim algorithm and Kruskal. In order to solve this problem can waste a long time, because the time that will need to find the solution is move exponentially. More complex problem that happened is directly proportional with the time that move exponentially. The problem that often emerged is how to make a MST to solve some problems on transportation network design. There are some solution that can be applied such as Genetic Algorithm, Ant Colony Optimization, Particle Swarm Optimization, and many others.

Conclusion and Challenges

Exact algorithm consistently might produce better solution quality if compared to heuristic algorithm eventhough it spends longer time. But, the simplicity of heuristic algorithm on its application, made it become a popular algorithm to use for problem solving. Every algorithm has its weaknesses and superiority if compared to one to another. Furthermore, MST problem solving will be applied to solve logistic problem in Indonesia mainly the movement of boat/ship passengers, containers and inter-island commodity in Indonesia.

2010 Mathematics Subject Classification: 90B06, 05C85, 80M50.
Keywords: logistic, MST, soft computing, heuristic.

CT-54. Unsteady MHD second grade fluids flow with radiation effects

Zulkhibri Ismail[1], Ahmad Qushairi Mohamad[2], Ilyas Khan[3], Nadirah Mohd Nasir[1], Sharidan Shafie[2]
[1]Universiti Malaysia Pahang, [2]Universiti Teknologi Malaysia
[3]College of Engineering Majmaah University, Saudi Arabia
zulkhibri@ump.edu.my, nadirah@ump.edu.my, ahmadqushairi91@yahoo.com, sharidan@utm.my, ilyaskhanqau@yahoo.com

This paper examined the unsteady MHD flow of second grade fluids in a porous medium with radiation effects and the presence of heat and mass diffusion. It is assumed that the unsteady two dimensional momentum, energy and concentration equations are modeled in the form of partial differential equations with bounding infinite inclined isothermal plate. Closed-form solutions in general form are obtained by using the Laplace transform technique. The obtained results for velocity, temperature and concentration are presented graphically to analyze the effect of

parameters such as second grade, MHD, radiation and porosity. The results also satisfy all initial and boundary conditions, and can be reduced to known solutions from the literature as limiting cases. It is worth to mention that, the results are found identical, which show the validity of the obtainable solutions.

2010 Mathematics Subject Classification: 34B05, 35G16, 44A10, 76R10, 76S05, 76W05.
Keywords: free convection, second grade fluids, MHD, porous medium, inclined plate.

CT-55. Estimating the relative fitness of competing bacterial populations: is Lenski method appropriate enough?

Faradillah Haryani
Universitas Negeri Surabaya
faradillah.haryani@outlook.com

Understanding the evolutionary changes in bacteria is the key to understanding many behaviours in microbiology. The development of antibiotic resistance, for example, is considered to be driven by evolutionary change. Fitness is supposed to be one of main factors explaining evolutionary change. This project aims to develop an improved method to estimate the relative fitness of bacteria. This is started by showing when Lenski method, the existing method which was developed by Lenski in the 1990 for estimating relative fitness, and is widely used throughout microbiology, is inappropriate. The Lenski method manipulates an equation which represents exponential growth of bacteria, but the simplifications required to produce this result are not always appropriate to the available experimental data. For example, under the competition experiments between two strains, the medium conditions become limited (i.e when no more glucose is available or when starvation phase starts). This phase is not captured by Lenski's. Lenski's method is only valid when the data measurements are taken while bacteria are growing exponentially. However, in reality, measurements are often taken at stationary phase. Therefore, this project will investigate alternative options, including using the equation represents logistic growth (rather than exponential growth) and modifications to this equation that can account for starvation phase. The developed method and the existing method will be tested by using data measure from the bacterium *Eschericia coli* in the Lund laboratory at the University of Birmingham. The Lund laboratory have monitored growth of particular strain of *E. coli* in various different mediums of different pH and measured this using OD602 measurement. We will fit the data to both methods by minimising the norm difference between the experimental data and the model solution. Further, this project mainly used ODE analysis, parameter fitting in MATLAB, and basic statistic. Finally, This project is successfully giving better estimation of relative fitness than the one obtained from Lenski method. The Lenski method gives the unreliable estimation of s, $s = 0.00002$ which is approximately zero, which means that the growing rate of both strains are approximately the same, which is impossible. Furthermore, this method is also able to overcome the inappropriateness of Lenski method in estimating relative fitness of competing

bacteria.

2016 Mathematics Subject Classification: 03B70, 65E99.
Keywords: relative fitness, bacteria, *E.coli*, Lenski method.

CT-56. MHD natural convection flow of ferrofluids along a vertical flat plate with newtonian heating

Mohd Rijal Ilias*[1,2], Noraihan Afiqah Rawi[1], Sharidan Shafie[1]
[1]Department of Mathematical Sciences, Universiti Teknologi Malaysia
[2]Department of Mathematical Sciences, Universiti Teknologi MARA, Malaysia
rijal_rs@hotmail.com, nafiqah38@gmail.com, sharidan@utm.my

The purpose of this paper is to investigate the steady natural convection boundary layer flow of magnetohydrodynamic (MHD) ferrofluids along a vertical flat plate with Newtonian heating. The problem is formulated to incorporate magnetic nanoparticle (magnetite) embedded within the two types of base fluids (water and kerosene). The similarity transformations are used to transform the governing two-dimensional nonlinear partial differential equations to a system of nonlinear ordinary differential equations. The transformed equations are then solved numerically using Keller Box method. The results are displayed graphically to illustrate the influence of the particle volume fraction parameter, the aligned and transverse magnetic field parameter and free convection parameter on skin friction and heat transfer coefficient as well as velocity and temperature profiles. The features of the flow and heat transfer characteristics for different values of these physical parameters are analyzed and discussed. The heat transfer rate at the plate surface with Fe_3O_4– kerosene ferrofluid is higher than Fe_3O_4– water. It is also noticed that the heat transfer rate at the plate surface increases with increasing angle of magnetic field, ferroparticle volume fraction, magnetic field parameter and local Grashof number. Present results are compared with the published papers and are found to concur very well.

2010 Mathematics Subject Classification: 76D10, 76R10, 76W05.
Keywords: ferrofluids, natural convection, Newtonian heating, vertical flat plate, aligned magnetic field, MHD.

CT-57. Robust algorithm for counting moving vehicle based on image processing

Reza Augusta Jannatul Firdaus*, Budi Setiyono, Dwi Ratna Sulistyaningrum
Institut Teknologi Sepuluh Nopember
reza.8th@gmail.com, masbudisetiyono@gmail.com, dwiratna@matematika.its.ac.id

The problem of traffic is one of the problems faced almost in every big cities. This is due to the increase number of vehicles that potentially cause an accident. Therefore it is necessary to analyze the traffic density to obtain information that

needed, such as the number of passing vehicles. One method that can be implemented is by doing the counting vehicle based on digital image processing. This research discussed about robust algorithm for counting vehicle in a traffic video. Processes such as background subtraction, noise removal, object detection and counting will be discussed therein. In the background subtraction method is used GMM (Gaussian Mixture Model), while in object detection will be checked neighbors on each pixel of the image. Robust process was carried out by analyzing when did the traffic video has been recorded (morning, noon, or afternoon) before determining the parameter that used for GMM. In other word, there is modificaton in GMM algorithm so that the parameter that used can be adaptive based on video input, and the counting result can be acurate.

2010 Mathematics Subject Classification: 68U10, 94A08, 60G35.
Keywords: counting, moving vehicle detection, image processing, robust, background subtraction.

CT-58. Hydromagnetic falkner-skan flow of Casson fluid past a moving wedge with heat and mass transfer

Imran Ullah[1], Asma Khalid[1], Ilyas Khan[2], Sharidan Shafie*[1]
[1]Dept. of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia
[2]Basic Sciences Dept., College of Engineering Majmaah University, Saudi Arabia
{ullahimran14, awaisiasma}@gmail.com, ilyaskhanqau@yahoo.com, sharidan@utm.my

This article focuses on steady two dimensional incompressible hydromagnetic boundary layer flow of Casson fluid over a moving wedge with combined effects of heat and mass transfer. The governing partial differential equations are transformed into ordinary differential equations using similarity transformations and then solved numerically by using Keller-box method. Numerical results for dimensionless local skin friction coefficient are computed and found in excellent agreement with published results. The effects of different physical parameters involved for various values on velocity and temperature profiles are discussed and illustrated graphically. It is found that velocity increases with increase of wedge angle parameter and Casson fluid parameter whereas dimensionless temperature decreases. Increasing the values of velocity ratio parameter the fluid velocity increases whereas decreases with the increase of magnetic parameter. The local skin friction increases with the increase of wedge angle and magnetic parameters while decrease as Casson fluid parameter increases. The rate of heat transfer is found to be increases with the increase of wedge angle and Casson fluid parameters. A significant result obtained from this analysis is that flow separation can be control if the wedge and free stream move with the same velocity.

2010 Mathematics Subject Classification: 76A05, 76W05, 76M20
Keywords: Casson fluid, heat transfer, moving wedge, MHD, numerical solutions.

CT-59. Modeling of knowledge dissemination

Mukhsar*, Pantry Elastic, Edi Cahyono
Department of Mathematics FMIPA, Universitas Halu Oleo, Kendari, Indonesia
mukhsar_unhalu@yahoo.com, pantry@yahoo.com, edi_cahyono@inov-center.org

This paper is motivated by the idea presented in [1]. While extreme ideology is destructive, on the opposite knowledge is constructive. Knowledge is also more serious compared to rumor [2]. Hence, the spread may have different characteristics. At first, we follow XYZR model discussed in [3], that is IASD from ignorant, antusiant, solariant and desiminant. Our model consists of two equilibrium points, which are stable. It is shown by the negative eigen values of their Jacobian matrices evaluated at those equilibrium points. One of the stable equilibrium points represents a society without knowledge that cannot develop knowledge for their own. As opposite, the other equilibrium point represents a knowledge society that does not allow ignorant member to exist. This result is opposite to the one in [1] as expected

2010 Mathematics Subject Classification: 00A71.
Keywords: modeling, knowledge dissemination.

CT-60. Finite Element model of size, shape and blood pressure on rupture of intracranial saccular aneurysms

Jennica Rica Nabong*[1], Carmela Sales[2], Guido David[1]
[1]University of the Philippines, [2]Philippine General Hospital
jennyrica@gmail.com, macarmelamd@yahoo.com, gdavid@math.upd.edu.ph

Rupture of intracranial saccular aneurysms is a primary concern for neurologists and patients because it leads to stroke and permanent disability. Rupture of saccular aneurysms occurs when the wall tension exceeds its mechanical strength. This paper examines the role of blood pressure, in connection with size of and wall thickness, in the rupture of saccular aneurysms. A bulb-shaped geometry of a saccular aneurysm is obtained from angiographic images of a patient and modeled using Finite Elements based on the principle of virtual work under the Fung stress-strain relationship. The numerical model is subjected to varying levels of systolic blood pressure. The results show which sizes of this class of aneurysms are at high risk of rupture given a patient's level of hypertension.

2010 Mathematics Subject Classification: 35Q74, 53C46, 92B08.
Keywords: cerebral aneurysm, mechanics, biomembrane, rupture, Fung constituitive equation, finite element method, stroke, hypertension.

CT-61. Fluid dynamic in the continuous stirred tank using finite element methods

Tulus*[1], Opim S. Sitompul[2], Sawaluddin[1], Rosdanelli Hasibuan[3]
Ahmad Kamal Ariffin[4]
[1]Department of Mathematics, University of Sumatera Utara
[2]Department Information Technology, University of Sumatera Utara
[3]Department of Chemical Engineering, University of Sumatera Utara
[4]Department of Mechanical Engineering, National University of Malaysia
{tulus, opim, sawal}@usu.ac.id, rosdanelli@yahoo.com, kamal3@gmail.com

The purpose of this paper is to present a numerical approach to solve boundary initial value problems (BIVPs) for a fluid dynamic phenomenon in the continuous stirred tank (CSTR). A model in the form of partial differential equation is derived based on the physical properties of fluid dynamic in CSTR. The analysis is perform by using the finite element analysis, i.e. a geometric modeling, material properties, boundary conditions, meshing and computation. The tank is designed in the form of cylindrical tank equipped with a stirrer. In this study, it is considered that the tank is filled with water. Stirring is done with a stirring speed of 10rpm, 15rpm, 20rpm, and 25rpm. Mathematical modeling of stirred tank is derived. The model is calculated by using the finite element method that are calculated using CFD software. The result shows that the shear rate is high on the front end portion of the stirrer. The maximum shear rate tend to a stable behaviour after the stirring time of 2 second. The relation between the speed and the maximum shear rate is in the form of linear equation.

2010 Mathematics Subject Classification: 65N30, 74S05, 76M10.
Keywords: finite element method, boundary value problems, partial differential equation, fluid dynamics.

CT-62. Moving vehicle classification based on pixel quantity

Bayu Charisma Putra*, Budi Setiyono, Imam Mukhlash
Dwi Ratna Sulistyaningrum
Institut Teknologi Sepuluh Nopember
{bayu.charisma.putra, masbudisetiyono}@gmail.com, {imamm, dwiratna}@matematika.its.ac.id

Transportation has a very important part of life, not only in economy, but also in social, political, and the others. One problems of transportation that often happen is the bottleneck. In order to reduce or even eliminate this problem, information related to traffic are needed, such as kind of vehicle that passes. In order to get that information, classification vehicle are needed. This research discussed classification of the types of vehicles based on pixel quantity. The first step, the input in the form of video recordings will be extracted into frames. Frame foreground will be extracted using Gaussian Mixture Models. Then the frame will be filtered to minimize noise. Next is shadow removal process in the foreground, and then the

object detection by examining the whole neighborhood of each pixel. The detected object was classified depend on pixel quantity and given a label according to the type of vehicle. The last stage is the tracking and counting vehicles that passing through the ROI (Region of Interest) according to the type vehicle. The expected result from this research is to yield an algorithm that can accurately classifying the vehicle.

2010 Mathematics Subject Classification: 68U10, 94A08.
Keywords: classification, filtering, background subtraction, shadow removal, object detection.

CT-63. Implementation of plaid model biclustering method on microarray of carcinoma and adenoma tumor gene expression data

Gianinna Ardaneswari*, Devvi Sarwinda, Alhadi Bustamam
Department of Mathematics Universitas Indonesia
{ninna, devvi, alhadi}@sci.ui.ac.id

A tumor is an abnormal growth of cells that serves no purpose. Carcinoma is a tumor that grows from the top of the cell membrane and the organ adenoma is a benign tumor of the gland-like cells or epithelial tissue. In the field of molecular biology, the development of microarray technology is used in the data store of disease genetic expression. For each of microarray gene, an amount of information is stored for each trait or condition. In gene expression data clustering can be done with a bicluster algorithm, that's clustering method which not only the objects to be clustered, but also the properties or condition of the object. This research proposed Plaid Model Biclustering as one of biclustering method. In this study, we discuss the implementation of Plaid Model Biclustering Method on microarray of Carcinoma and Adenoma tumor gene expression data. From the experimental results, we found three bicluster are formed by Carcinoma gene expression data and four bicluster are formed by Adenoma gene expression data.

2010 Mathematics Subject Classification:91C20.
Keywords: plaid model biclustering, microarray analysis, gene expression data, tumor.

CT-64. A multigrid approach for state-constrained optimal control problem with bilinear state equation

Arrianne Crystal T. Velasco*[1], Michelle C. Vallejos[2]
[1]Institute of Mathematics, College of Science, University of the Philippines-Diliman
[2]Department of Mathematics, Technische Universität Darmstadt
acvelasco@math.upd.edu.ph, mcvallejos@math.upd.edu.ph

An optimal control problem is an optimization problem with PDE-constraints that involves splitting the optimization variable into a state and a control. Our center of interest is the numerical solution of the class of optimal control problems with bilinear elliptic state equation and pointwise state constraints. In this

problem, the state variable is subject to inequality constraints so that unwanted phase or transitions in the system is avoided. However, it is known that Lagrange multipliers associated with the state constraints are only Borel measures and so known approximation techniques cannot be used. Thus, in order to obtain regular Lagrange multipliers, Moreau- Yoshida regularization method is applied. Next is we determine the first-order necessary optimality conditions for the regularized prob- lem and is then discretized using finite difference method. Now, the multigrid method is used to solve the discretized optimality system. The multigrid method approaches the problem on different mesh grid level then combining the results on each grid level to obtain a fast and accurate solution. In particular, Collective smoothing multigrid (CSMG) method with local Newton method as a smoother is utilized.

2010 Mathematics Subject Classification: 49J20, 65K10, 49M15.
Keywords: optimal control, multigrid, state-constrained.

CT-65. Super-resolution imaging applied to moving object tracking

Galandaru Swalaganata*, Dwi Ratna Sulistyaningrum, Budi Setiyono
Institut Teknologi Sepuluh Nopember
galandaru.swalaganata@gmail.com, dwiratna@matematika.its.ac.id, masbudisetiyono@gmail.com

Moving object tracking in a video is a method used to detect and analyze changes that occur in an object that being observed. The ability to obtain visual quality and the precision of the tracked target is highly whised in modern tracking system. The fact that the tracked object does not always seem clear causes the tracking result less precise. The reasons are low quality video, system noise, small object, and other factors. In order to improve the precision of the tracked object especially for small object, we propose a simple solution that integrates a super-resolution imaging into tracking approach. First step, super-resolution imaging applied into tracked target. Super-resolution image is a technique to obtain high-resolution images from low-resolution images. In previous research, super-resolution imaging based on gradient-descent motion estimation techniques, while the tracking based on Sum of the Absolut Differences (SAD). In that research should take a long computation time and large memory requirements caused by multi frame super-resolution technique and the tracking technique. In this research, we use single frame super-resolution technique. Single frame super-resolution is a kind of super-resolution that it has the advantage of fast computation time. Second step is tracking the result of tracked target that has been super-resolution. The method used for tracking is Camshift and Kalman filter. The advantages of Camshift are histogram can be used on the condition and color of the object varies. Kalman filter is used for refining the results tracking. The first step is only done when background and shape changes, while second step is for all frame of video. The computational complexity and memory requirements required for the implementation of super-resolution and tracking is reduced and the precision of the

tracked target is good. Experiment show that integrate a super-resolution imaging into tracking technique can track the object precisely with various background, shape changes of the object, and good light conditions.

2010 Mathematics Subject Classification: 68U10, 94A08, 60G35.
Keywords: Camshift method, Kalman filter, object tracking, super-resolution single frame.

CT-66. New modified map for digital image encryption and its performance

Suryadi M.T, Maria Yus Trinity Irsan*, Yudi Satria
Universitas Indonesia
yadi.mt@sci.ui.ac.id, maria.irsan@sci.ui.ac.id, ysatria@sci.ui.ac.id

Protection to classified digital data becomes so important in avoiding data manipulation and alteration. The focus of this paper is in data and information protection of digital images form. Protection is provided in the form of encrypted digital image. The encryption process uses a new map, $x_{(n+1)} = (rx_n)/(1 + (1 - x_n)^2)(\mod 1)$, which is called MS map. This paper will show: the results of digital image encryption using MS map and how the performance is regarding the average time needed for encryption/decryption process; randomness of key stream sequence with NIST test, histogram analysis and goodness of fit test, quality of the decrypted image by PSNR, initial value sensitivity level, and key space. The results show that the average time of the encryption process is relatively same as the decryption process and it depends to types and sizes of the image. Ciphertext (encrypted image) is uniformly distributed since: it passes the goodness of fit and also the histogram is flat; key stream, that are generated by MS map, passes frequency (monobit) test, and runs test, which means the key stream is a random sequence; the decrypted image has same quality as the original image; and initial value sensitivity reaches 10^{-17}, and key space reaches 3.24×10^{634}. So, that encryption algorithm generated by MS map is more resistant to brute-force attack and known plaintext attack.

2010 Mathematics Subject Classification: 94A60
Keywords: MS map, logistic map, encryption and decryption algorithm, digital image, key stream, NIST, goodness of fit, PSNR.

CT-67. Prediction DNA sequens in influenza a virus using hidden Markov models

Harmuda Pandiangan*, M. Isa Irawan
Institut Teknologi Sepuluh Nopember Surabaya
harmuda.pandiangan@gmail.com, mii@its.ac.id

DNA testing is the method to aligned sequences to DNA sequences between one another. Sometimes the structure of the sequences to be aligned incomplete or truncated. So we need a method to predict DNA sequens actually. To predict

the DNA sequens are missing we use Hidden Markov Models (HMMs). Hidden Markov Models(HMMs) is a stocastical model of a system that is assumed to be a markov process with unknown parameters. This research uses DNA sequences (A,C,G,T) as hidden state and amino acid as observable state. Hidden Markov Models created after obtainded a transsition matrix from hidden states. Transition matrix is obtained by count opportunity alteration DNA sequens from $t = 0$ to $t = N - 1$. Then we have a matrix A$[4, 4]$ that every elemen of matrix A is opportunity of each sequences. Opportunity between amino acid and DNA sequences notated as B emission matrix. This research uses viterbi algorithm to find the best path from each state. Viterbi algorithm is used to search for state optimal. Data used amino acid Influenza virus type A obtainded from National Center for Biotechnology Information (NCBI). The result shows that the Hidden Markov Models can used to predict the DNA sequences of Influenza virus type A based on amino acid Influenza A.

2010 Mathematics Subject Classification: 15A60.

Keywords: Hidden Markov Models, viterbi algorithm, transition matrix, emission matrix, amino acid.

CT-68. An agent based model of the spread of radical ideology with some results of rehabilitation program

Bevina D. Handari*, Hengki Tasman
Departemen Matematika, Universitas Indonesia
bevina@sci.ui.ac.id, htasman@sci.ui.ac.id

Radical ideology has appeared in many places recently. Many peoples are involved in the spread of the ideology. The radical ideology is often followed by destructive actions, such as terrorism. Hence, their spread should be controlled. People with radical ideology should be deradicalized. Unfortunately, deradicalization programs have various results.

We formulate an agent based model to measure the various results to population. ABM is a computational method that enables a researcher to create, analyze, and experiment with models composed of agents that interact within an environment. Agents have attributes to characterize them, and the rules that will affect the relationship between agents and an environment. Repetitive interactions between agents are a feature of ABM, which relies on the power of computers to explore dynamics out of reach of pure mathematical models, such as system of partial differential equations.

In this research, the model construction is divided into four classes, namely general class (G), class of low-fanatic (F_1), class of high fanatic (F_2), class of rehabilitation (P). The attributes used are age, frequency of interactions with F_1, rehabilitation term of P. The results of model construction are the rules how an agent can move from one class to another class based on age, distance between agents, frequency

of interactions between agents, and opportunities of agents for moving between classes. The opportunity is represented by the generated random numbers.

We use internal validity technique in validating the model, by comparing some simulation results using the same parameters and initial values. One of the simulations shows that there is an impact of the choice of parameters to the size of subpopulation F_1.

The simulation using NetLogo 5.2 and Mathematica 10.2. The simulation also gives the sensitivity of the parameter to the population.

2010 Mathematics Subject Classification: 91D10, 91D30, 91B69.
Keywords: agent based model, radical ideology, netlogo.

CT-69. Influence of aligned magnetic field on MHD natural convection flow of ferrofluids along a moving vertical flat plate

Mohd Rijal Ilias*[1,2], Noraihan Afiqah Rawi[1], Sharidan Shafie[1]
[1]Dept. of Mathematical Sciences, Fac. of Science, Universiti Teknologi Malaysia
[2]Dept. of Mathematical Sciences, Universiti Teknologi MARA, Malaysia
rijal_rs@hotmail.com, nafiqah38@gmail.com, sharidan@utm.my

In this paper, the influence of aligned magnetic field on magnetohydrodynamic (MHD) ferrofluids natural convection boundary layer flow of along a moving vertical flat plate. The problem is formulated to incorporate magnetic nanoparticle (magnetite) embedded within the two types of base fluids (water and kerosene). The governing partial differential equations are reduced to ordinary differential equations and solved numerically by using Keller Box method. The effects of the governing parameters on the dimensionless velocity, temperature, skin friction and Nusselt numbers are investigated and presented with the help of graphs and tabular forms. It is found that aligned magnetic field and Grashof number play significant role on MHD natural convection flow during heat transfer. The numerical results of skin friction and Nusselt numbers are compared with the existed studies under some special condition and are found in a good agreement.

2010 Mathematics Subject Classification: 76D10, 76R10, 76W05.
Keywords: ferrofluids, natural convection, moving vertical flat plate, aligned magnetic field, MHD.

CT-70. A numerical method for time-dependent water absorption by plant roots

Imam Solekhudin[1], Keng Cheng Ang[2]
[1]Department of Mathematics, Universitas Gadjah Mada, Indonesia
[2]Mathematics and Mathematics Education, NIE-NTU, Singapore
imams@ugm.ac.id, kengcheng.ang@nie.edu.sg

In this paper, we investigate water absorption in root zone from a time-dependent infiltration problem from periodic channels. Time-dependent infiltration

problem from periodic channels with root-water uptake is governed by Richards equation. To study the problem numerically, the governing equation is transformed into a modified Helmholtz equation using the Kirchhoff transformation, dimensionless variables, and Laplace transforms. The modified Helmholtz equation is then solved numerically using a dual reciprocity boundary element method (DRBEM) and a predictor-corrector scheme simultaneously. A numerical inverse Laplace transform is employed to obtain numerical solutions of the problem.

2010 Mathematics Subject Classification: 15A60.
Keywords: infiltration, water absorption, dual reciprocity boundary element methods, modified Helmholtz equation, predictor-corrector scheme.

CT-71. Junction tree construction techniques: application to Bayesian networks

Linda Smail
Zayed University
linda.smail@zu.ac.ae

Given a Bayesian network over a set of random variables $(X_i)_{i\in I}$ and $\mathcal{C} = (C_1, \ldots, C_n)$ a set of cliques that covers the Bayesian network. Inference in Bayesian networks consists of computing probabilities P_A (the probability of $X_A = (X_i)_{i\in A}$ where $A \subseteq I$) and $P_{A|B}$ (probability of X_A conditioned on X_B, where A and B are two disjoint subsets of I). A lot of algorithms have been proposed for such computations, in this paper, we are interested in the Junction tree algorithm where inference is conducted through massage passing in a junction tree representation of the Bayesian networks. So, the first step in the inference algorithms is the transformation of the Bayesian network graph to a junction tree $\mathcal{J}$ such that, for each $J \in \mathcal{J}$ it exists a subset C of $\mathcal{C}$ such that $J \subseteq C$. Two main methods exist in the literature, the first classical one, which is implemented in a number of software dealing with inference in Bayesian networks, is the method by moralization and triangularization. The second one is the method by recursively constructing a junction tree $\mathcal{J} = (J_1, \ldots, J_m)$ that has the running intersection property, i. e., for each pair of nodes, J_1 and J_2, all nodes on the path between J_1 and J_2 contain the intersection $J_1 \cap J_2$. In this paper we will consider the second method, we will present two versions, where the second is a new one, of recursive construction of a junction tree; we will present a few examples of such a construction. The second version of the method will improve significantly the original method.

2010 Mathematics Subject Classification: 90B10, 68R01, 62F15
Keywords: Bayesian networks, Junction trees, running intersection property.

CT-72. A new generalized fuzzy multi-criteria decision making approach for solving green supplier selection problem

Luu Quoc Dat
University of Economics and Business, Viet Nam National University
datluuquoc@gmail.com or datlq@vnu.edu.vn

Green supplier selection has become an extremely important business activity for companies to gain a competitive advantage and improve environmental sustainability. To select the most suitable supplier, many traditional economic and environmental criteria must be considered in the selection process. Although numerous studies have developed different fuzzy multiple criteria decision making (MCDM) methods for solving supplier selection problem, only some studies have taken into account the environmental issues. Futher, most the existing fuzzy MCDM methods used normal fuzzy numbers or transformed generalized fuzzy numbers to the normal forms and thusled to the loss of information.

This study proposes a new fuzzy MCDM approach to solved green supplier selection. The proposed approach allows the ratings of alternatives and the importance weights of criteria for green supplier selection to be expressed in the generalized fuzzy numbers. Green supplier selection criteria include the economic and environmental criteria. A weighted fuzzy decision matrix is then derived by multiple the ratings of alternatives and the importance weights of criteria. Then, the weighted ratings are defuzzified into crisp values using the most recent centroid-index ranking approach to make the procedure easy and practical. A case study is used to illustrate the computation procedure of the proposed approach, which is compared with another fuzzy MCDM approach to demonstrade its advantages.

2010 Mathematics Subject Classification: 03B52.
Keywords: green suppler selection, generalized fuzzy numbers, fuzzy MCDM, centroid-index.

CT-73. The enumeration of Euclidean self-dual skew-cyclic codes over finite fields

Irwansyah*[1,2], Intan Muchtadi-Alamsyah[1], Djoko Suprijanto[3], Aleams Barra[1]
Ahmad Muchlis[1]
[1]Algebra Research Group, Institut Teknologi Bandung
[2]Mathematics Department, Universitas Mataram, Indonesia
[3]Combinatorial Research Group, Institut Teknologi Bandung
irw@unram.ac.id, {ntan, djoko, barra, muchlis}@math.itb.ac.id

Skew-cyclic codes or θ-cyclic codes over finite fields are generalization of cyclic codes over finite fields. Here, θ is an automorphism in the corresponding finite fields. This class of codes has many interesting properties such as it can be viewed as a left ideal or left submodule over a skew-polynomial ring, *etc.* Moreover, these codes also give $[38, 18, 11]$ code, an Euclidean self-dual code over $\mathbb{F}_4$, which breaks the record of optimal self-dual codes with respect to Hamming distance. In this

talk, using the results that the θ-cyclic codes are equivalent to cyclic codes or quasi-cyclic codes over finite fields, we give the enumeration of Euclidean self-dual skew-cyclic codes over finite fields when $(n, |\theta|) = 1$ and for some cases when $(n, |\theta|) > 1$.

2010 Mathematics Subject Classification: 11T71.

Keywords: skew-cyclic codes, Skew-polynomial ring, Euclidean self-dual codes, Hamming distance, cyclic codes, quasi-cyclic codes.

CT-74. Fuzzy functional and implication dependency using relational calculus

Mohammad Deni Akbar*[1], Yoshihiro Mizoguchi[2]
[1]Graduate School of Mathematics Kyushu University
[2]Institute of Mathematics for Industry Kyushu University
m-akbar@math.kyushu-u.ac.jp, ym@imi.kyushu-u.ac.jp

We show the soundness and the completeness of Armstrong's inference rules of the Functional Dependency (Implication or Association rule) with respect to fuzzy relational databases. Okuma and Kawahara improved relational database aspects using Dedekind category.In 2009, Ishida et al. presented relational formulations for Armstrong's inference rules and implication in a Dedekind category.They showed a relation algebraic proof of the completeness theorem for Armstrong's inference rules in a Schröder category. We follow their approach introduced by Okuma, Kawahara and Ishida especially focusing on fuzzy relations using relational calculus. Ganter and Wille investigated formal concept analysis, they introduced properties such as equivalence relation, implication dependency, functional dependency, etc. We also extend the notions using relational calculus. We introduce the formalization of fuzzy equivalence relation, fuzzy implication dependency and functional dependency. The formalization can be use to analyze equivalent condition between functional and implication.

We prove theorems in our formalization of fuzzy concepts using relational calculus. Since our proof is using relational calculus, it is simple and its correctness can be easily verified. We also show the logical comparison between fuzzy implication dependency and functional dependency. Further, the comparison is important aspects for making algorithm of fuzzy functional and implication dependency.

Finally, we explain implemented operations in our fuzzy formal concept analysis using Mathematica. We show some examples in the application of data analysis. Since formal concept analysis is important theory in data analysis, we believe our formalization useful for data analysis. Future work includes to construct a theory of fuzzy relational database theory with computer verified formal proofs using relational calculus.

2010 Mathematics Subject Classification: 03B52, 08A72, 18B10, 68P15, 68Q60.

Keywords: fuzzy logic, fuzzy relation, functional dependency, dedekind category, computational models.

CT-75. Mathematical model palatine rugae subras deuteromelayu in forensic dentistry

Sudradjat Supian*[1], H. Fahmi Oscandar[2], Intan Nurrsamsi[2]
[1]Department of Mahematics Universitas Padjadjaran
[2]Faculty of Dentistry Universitas Padjadjaran
adjat03@yahoo.com, fahmioscandar@yahoo.co.id, intannursamsi@yahoo.com

A mathematical model is a description of a system that uses mathematical concepts and language. The process of developing a mathematical model called mathematical modeling. Mathematical models are used not only in the natural sciences and engineering disciplines, but also in social sciences (such as economics, psychology, sociology and political science, medical and dentistry) used a mathematical model that is most widespread. A model may help to explain the system and to study the effects of different components, and to make predictions about the behavior. Mathematical models can take many forms, including but not limited to dynamical systems, statistical models, differential equations, or game theory models. In general, the mathematical model can include logical models, as far as logic is taken as a part of mathematics. This research design a mathematical model of the palatine rugae subras deuteromelayu with a mathematical model approach fingerprints. Rugae palatine is an organ that has the unique properties of each individual person, palatine rugae can be analyzed through the number, length, direction, and shape. The uniqueness of every shape and pattern of the palatine rugae can be used as the basis for the identification of individuals.

2010 Mathematics Subject Classification: 00A71, 37C45, 46N30, 97E30.
Keywords: Mathematical model, fingerprints, rugae palatina, forensic, dentist.

CT-76. Robust GK fuzzy clustering algorithms with cluster core and analysis on parameter selection

Winsy Weku*[1], Miin-Shen Yang[2]
[1]Mathematics Department, Sam Ratulangi University, Indonesia
[2]Department of Applied Mathematics, Chung Yuan Christian University, Taiwan
winsyweku@gmail.com, msyang@math.cycu.edu.tw

FCM is one such clustering technique that use Euclidean distances to calculate the centers of the cluster between data points in the objective function and it work very good for spherical shaped clusters. To overcome the above drawback, then Gustafson and Kessel porpose the first extension of FCM which known as GK algorithm. They extended the Euclidean distances of the standard FCM by employing an adaptive norm, in order to detect clusters of different geometrical

shape without changing the clusters sizes in one data set. In this paper we propose the use fuzzy based classification techniques for several datasets to identfy the parameter m, that can influence the performance of GK. On the basis of a robust analysis of GK, we will show that a large m value will make FCM more robust to noise and outliers by selecting the parameter m. Using large m values that are greater than the theoretical upper bound will make the sample mean a unique optimizer or the cluster will become one. Based on GK algorithms, through simulation we obtain the upper bound m^{bound} of the simulation for each data set are different. The same principle is also applied to integrate PIM and alpha-cut into GK algorithm to extend the upper bound. In conclusion, when we choose a fuzziness index m for GK algorithm, it is better not too close to simulation upper bound m^{bound}. We suggest implementing GK with interval $m \in [1.5, 5.4]$.

2010 Mathematics Subject Classification: 91C20.

Keywords: GK-algorithm, upper bound parameter m , cluster core.

Poster Sessions

P-01. Surface wave analysis by wavelet transform

Sunjay, Manas Banerjee
Geophysics, BHU, Varanasi-221005, India
Sunjay_sunjay@yahoo.com

Multichannel Analysis of Surface Waves (MASW) method is one of the Seismic Survey methods evaluating the elastic condition (stiffness) of the ground for geotechnical engineering purposes. MASW first measures seismic surface waves generated from various types of seismic sources-such as sledge hammer-analyzes the propagation velocities of those surface waves, and then finally deduces shear-wave velocity (Vs) variations below the surveyed area that is most responsible for the analyzed propagation velocity pattern of surface waves. Shear-wave velocity (Vs) is one of the elastic constants and closely related to Young's modulus. Under most circumstances, Vs is a direct indicator of the ground strength (stiffness) and therefore commonly used to derive load-bearing capacity. The Spectral Analysis of Surface Waves (SASW) method is applied to soil sites to measure the in-place shear wave velocity profile of soil and rock without requiring a borehole. In general, the method uses the dispersive characteristics of surface waves to determine the variation of the shear wave velocity (stiffness) of layered systems with depth. Once the shear wave velocity profiles are determined, shear and Young's moduli of the materials can be estimated through the use of simple mathematical equations. The shear wave velocity profiles (shear wave velocity versus depth) are determined from the experimental dispersion curves (surface wave velocity versus wavelength) obtained from SASW measurements through a process called forward

modeling or through an inversion process. The SASW method can be performed on any material provided there is an accessible surface for receiver attachments and source impacting. wavelet transform for multichannel surface wave method to overcome the limitations of conventional seismic signal analysis for noise reduction for surface wave analysis regarding multichannel and wavelet transform.Seismic surface wave method is familiar nondestructive seismic test to reveal the soil profile in geotechnical engineering. The spectral analysis surface wave method using two receivers is constraint due to interferences of other signals and various types of noises.Applications of surface wave analysis for geotechnical,engineering geology- Determination of pavement system profiles including the surface layer, base and subgrade materials;Determination of soil velocity profiles needed for earthquake and dynamic loading analysis;Determination of abutment depths of bridges;Condition assessments of concrete liners in tunnels, and other structural concrete conditions; Shear wave velocity, depth to and shape of bedrock and soil stiffness estimates, etc.

2010 Mathematics Subject Classification: 65T60.
Keywords: MASW, SASW, wavelet transform, geotechnical investigation.

P-02. Activation functions comparison in higher order network

Saratha Sathasivam*[1], Muraly Velavan Doraisamy[2]
[1]School of Mathematical Sciences, Universiti Sains Malaysia, Penang
[2]School of General and Foundation Studies, AIMST University, Malaysia
saratha@usm.my, dsmuraly@yahoo.com

Higher-order network structure is important in doing higher order programming because high-order neural networks have converge faster and have a higher memory and story capacity. Furthermore higher order networks also have higher approximation ability and robust if compare lower-order neural networks. Thus, the higher-order clauses for logic programming in Hopfield Networks are been focused in this paper. We will limit till fifth order network due to complexity issue. Hereby we employed Hyperbolic tangent activation function, Modifying Activation Function and Pseudo Inverse Rule to compare the performance of doing logic programming in higher order network to increase the performance of neuro symbolic integration. We used computer simulation to verify the effectiveness of the activation function used.

2010 Mathematics Subject Classification: 90B10.
Keywords: Hopfield network, higher order, hyperbolic tangent activation function, modifying activation function, pseudo inverse rule.

P-03. Short segment search method for phylogenetic analysis using nested sliding window

Afif Akbar Iskandar*[1], Alhadi Bustamam*[1], Hidayat Trimarsanto*[2]
[1]Department of Mathematics, Universitas Indonesia
[2]Eijkman Institute for Molecular Biology
{afifai, alhadi}@sci.ui.ac.id, anto@eijkman.go.id

In order to analyze phylogenetic on dengue virus IV, coding DNA sequence (CDS) or whole genome segment is needed for maximal accuracy. However, phylogenetic analysis using CDS cost a lot of time and money, so a representative short segment by CDS which is envelope protein segment or nonstructural 3 (NS3) segment is necessary. After sliding window is implemented, a better short segment than envelope protein segment and NS3 is found. The result shows that our method can find a short segment which more representative about 6.57% in topological view to CDS segment than an Envelope segment or NS3 segment. This paper will discuss a mathematical method to analyze sequences using nested sliding window to find a short segment which is representative for the whole genome.

2010 Mathematics Subject Classification: 68W32, 92-08.
Keywords: bioinformatics, phylogenetic, sliding window, cds, ns3.

P-04. The implementation of Self Organizing Maps (SOM) partitioning algorithm in HOPACH clustering method

S. Wulandari, A. Bustamam, T. Siswantining
Departement of Mathematics, FMIPA, Universitas Indonesia
septian.wulandari@sci.ui.ac.id, alhadi@sci.ui.ac.id, titin@sci.ui.ac.id

Since the discovery of DNA structure in form of double helix, there are more development in method to understand the more complex interaction involving DNA such as DNA clustering. DNA Clustering can be used to find the clusters of DNA that might have the same features or functions. DNA clustering can be done by applying partitional or hierarchical method. Those two methods can be combined by doing partitional and hierarchical stage alternately known as HOPACH clustering. In partitional stage, several algorithm can be used including SOM, PAM, and k-Means, and others. In this study, we apply SOM algorithm since it uses unsupervised learning method and efficient to be used for large data. The partitional process is continued by ordering process and then performed hierarchical proses by collapsing with agglomerative process to produce more acurate clustering results. To determine the number of main clusters, we calculate the homogeneous value of the clustering results using MSS (Mean Split Silhouette) value. The criteria of the main cluster is the smallest MSS value of the clustering results. In this study, the dataset consists of 136 sequences of DNA EVD (Ebola Virus Disease) obtained from NCBI GenBank. We use the features extraction of DNA sequence using nmers frequency to compute the features matrix. Furthermore, we normalize

the features matrix using min-max normalization, and then calculating the genetic distance using Euclidean Distance. Genetic distance matrix can be used as a basis to do partitioning process in SOM partitioning algorithm in HOPACH clustering method. We develop the features extraction of DNA sequence, normalization, and the implementation of SOM partitioning algorithm for this HOPACH clustering method using open source program R. As the result we found 9 clusters with MSS value of 0,50280. The cluster results can be identified according to species and the first year of the virus becoming an epidemic.

2010 Mathematics Subject Classification: 62P10, 62H30, 91C20, 92B15.
Keywords: clustering, HOPACH, MSS, SOM, R.

P-05. The implementation of fuzzy C-means partitioning algorithm in HOPACH clustering method

G. Suryawati*, A. Bustamam, D. Lestari
Department of Mathematics, FMIPA, Universitas Indonesia, Depok 16424
ghea.suryawati@sci.ui.ac.id, alhadi@sci.ui.ac.id, dian.lestari@sci.ui.ac.id

One of the way to know the function of DNA (Gene/Protein) is by clustering analysis. HOPACH clustering is combining the agglomerative and partition method. The partition that can be use in hard clustering. In some cases, clustering by hard clustering can cause an error. So that is the reason why fuzzy set theory occurs and became the fondation of fuzzy clustering . One of fuzzy clustering is Fuzzy C-Means (FCM) which is developed from K-Means. The result from the implementation of FCM partitioning algorithm in HOPACH clustering method which is the steps are characteristics extraction, partition using FCM, choosing the best cluster with the minimum MSS, ordering and collapsing. The process need done by iteration until the stopping criteria has reached. In the implementation of FCM partition of FCM partitioning algorithm in HOPACH clustering method, normalization process can be deleted. Because the FCM already solve the outliers problem. This disadvantage of this implementation is running time program need quite along time for the small tolerance limits. In the application case, the result show there are 8 clusters with MSS value of 0.53946 using normalization and 7 clusters with MSS value of 0.50753 without normalization.

2010 Mathematics Subject Classification: 62P10, 62H30, 91C20, 92B15.
Keywords: DNA, Clustering, FCM, HOPACH, MSS.

P-06. Student based course timetabling problem: a case study

San-Nah Sze, Chia-Lih Bong, Noor-Alamshah Bolhassan, Kang-Leng Chiew
Wei-King Tiong
FCSIT, Universiti Malaysia Sarawak
snsze@unimas.my, lihlih1206@gmail.com, {bnalamshah, klchiew, wktiong}@unimas.my

This paper studies a real world faculty course timetabling problem. In our case study, the process of timetabling problem was overwhelmed with abundance of constraints and time consuming to even fine a feasible timetable. Unfortunately, a lot of manual adjustment is still needed once it is implemented. One of the major reason is no "pre-registration course system" being practiced at faculty. Thus, the timetable is developed with many uncertainties. Not only that, the number of students has increased dramatically in recent years due to new policy from ministry of higher education. Thus, timetabling problem has become tougher to manage manually or partially computational. The main objective of this study is to maximise the seat occupation rate of the classrooms. Due to this limited resource, all the courses are encourage to conduct in a mass lecture. However, splitting will be considered when only the bigger classroom is all taken. The contribution of this paper are to formally estimate the potential students as data pre-processing and present a two-stage constructive algorithm with students sectioning consideration. A three-semester of real data (Sem 1 2011/2012, Sem 1 2014/2015 and Sem 2 2014/2015) from Faculty of Computer Science and Information Technology, UNIMAS was studies to compared our proposed algorithm and previous model. The generated result superior to the previous practice at faculty, in both solution's quality and efficiency. It provides a clash-free solution which the previous practice fails to do. Furthermore, the objective of evenly distributed timetables is achieved.

2010 Mathematics Subject Classification: 90B35.
Keywords: student's based, lack of pre-enrollment system, student sectioning.

P-07. A LTDRM with a predictor-corrector scheme for time-dependent infiltration from periodic channels at different types of homogeneous soils with root-water uptake

Millatuz Zahroh, I Solekhudin
Departement of Mathematics, Gadjah Mada University, Indonesia
millatuz.zahroh@mail.ugm.ac.id, imams@mail.ugm.ac.id

The Darcy law for flow equation is derivied to govern a model for infiltration problems into a non-linear partial differential equation which is known as Richard's equation. To get an apt formulation, the Richard equation is transformed into a modified Helmholtz by using the Kirchhoff transformation with dimensionless variables and a Laplace transform (LT) for time-dependent case. Finally, the governed modified Helmholtz equation is solved numerically with dual reciprocity method (DRM) and the predictor-corrector method with mixed boundary condition based

on periodic trapezoidal channels. The proposed method is tested on problem involved in time-dependent infiltration at different types of homogeneous soil with root-water uptake process.

2010 Mathematics Subject Classification: 35J05, 65M38, 86A05.
Keywords: infiltration, Richard equation, Helmholtz equation, LTDRM, predictor-corrector scheme.

P-08. Invigilator scheduling for faculty final examination

San-Nah Sze, Mei-Gie Teo, Kang-Leng Chiew, Wei-King Tiong
FCSIT, Universiti Malaysia Sarawak
snsze@unimas.my, mgteo.fit@gmail.com, klchiew@unimas.my, wktiong@unimas.my

This paper studies a real world final examination problem, focuses on invigilator scheduling. The scheduling problem involves assigning invigilators to exam-rooms. Invigilator scheduling problem has received less attention compared to examination timetabling problem due to different invigilation practices from institutes such as employ external staff, internal staff or a mixture between it. In our case study, the invigilators are all faculty internal staff, both academic and supporting staff. Each exam-room involves the course lecturer, a head of invigilator and a minimum number of assistant invigilators. Each invigilator is assigned at most invigilation duty at a time. Besides fulfilling all hard constraints, we also taking the considerations of fairness invigilation duties (including day and evening time slots), mixture of gender assignment, rest day in between duties and unavailability periods of invigilators. A two-stage constructive algorithm was proposed, which stage I assigning the course lecturer followed by the stage II, assigning invigilators. Meanwhile, a fitness function is formulated to evaluate the soft constraints fulfillment. A two-semester final examination data (Semester 2 2013/2014 and Semester 1 2014/2015) from Faculty of Computer Science and Technology, UNIMAS was studies to compared our solution with previous practice. Both data sets have 70 staff to be assigned to 50 over examination courses. The generated result superior to the previous practice at faculty, in both solution's quality and efficiency (two weeks planning versus two seconds of computing time). It provides a clash-free solution which the previous practice fails to do. Furthermore, it achieves the objectives of fairness duties and gender mixture assignment. The proposed algorithm is accurately reflect the practicality of invigilator scheduling problem. Eventually, the algorithm has been implemented by faculty examination unit officially since Semester 2 2014/2015.

2010 Mathematics Subject Classification: 90B35.
Keywords: invigilator scheduling, fairness workload, final examination.

P-09. Wavelet transform in computational fluid dynamics

Sunjay, Manas Banerjee
Geophysics, BHU, varanasi-221005, India
Sunjay_sunjay@yahoo.com,manasgp@yahoo.co.in

Computational fluid dynamics data analysis by wavelet transform are employed for Hydrocarbon reservoir, Geothermal reservoir,geosequestration,Atmospheric,Ocean science studies,wind-energy turbine modeling, and Underground Coal Gasification, etc. Computational Fluid Dynamics (CFD) of turbulent flows is still a major challenge before research scientists. The need to accurately predict the effect of turbulent flows impacts virtually every fieldof science and engineering. The ability of wavelets to identify and isolate localized structures such as shock waves and vortices, combined with multiresolution analysis, made them fashionable for adaptive computational approaches and turbulence modeling.Turbulence is characterized by its intrinsic multiscale behavior, itsselforganization into coherent structures, and a generic randomness. The major computationalchallenge comes from the fact that turbulence is active over a large and continuous range of length-scales, which increases with Reynolds numbers .Wavelet-based turbulence models rely onthe dynamically active scales in turbulent flows whichare not distributed homogeneously, neither in spacenor in time, which corresponds to the flow intermittency. By this property, a suitablerepresentation of the flow should reflect the sparsity of the fine-scale activity, in both space andtime. Wavelets yield a compressed representation of turbulent flow fieldswith the largest in magnitude coefficients, are sufficient to represent the dynamically active partof the flow.Wavelets offer a unique hierarchical framework for modeling and simulating turbulent flows-based on the ability of wavelet multiresolution analysis to identify and isolate the energetic coherent structures that govern the dynamics of the flow. Sparse (compressed) representations ofturbulent flow fields coupled with wavelet-based numerical methods allow the tight integration ofthe numerics and physics-based modeling. COMSOL,ANSYSFluent,OpenFOAM softwares are used for Computatinal Fluid Dynamics analysis.For better understanding of fundamental turbulence physics , CFD essence Exascale computing -Incrementally advanced computing,Voracious computing,Transformational computing ,etc. The great frontier of computational physics and engineering is in the challenge posed by high-fidelity simulations of realworld systems, that is, in truly transforming computational science into a fully predictive science. Real-world systems are typically characterized by multiple, interacting physical processes ('multiphysics'), interactions that occur on a wide range of both temporal and spatial scales.

2010 Mathematics Subject Classification: 65T60.
Keywords: CFD, wavelet transform, turbulence, exascale computing.

P-10. Spatial data mining for evaluation standards of quality education in West Java using semiparametric geographical regression model

Atje Setiawan Abdullah[1], I Gede Nyoman Mindra Jaya*[2], Rudi Rosadi[1]
Budi Nurani Ruchjana[3]
[1]Department of Computer Science, Universitas Padjadjaran, Indonesia
[2]Department of Statistics, Universitas Padjadjaran, Indonesia
[3]Department of Mathematics, Universitas Padjadjaran, Indonesia
{atjesetiawan, jay.komang, rudirosadi, bnurani}@gmail.com

In addition to the Accreditation of Schools, the National Examination can be an important indicator to assess the quality of the school. National Examination must have a positive correlation with the eight quality education standards used in the accreditation evaluation. To improve the attainment of graduates from the National Exam, the school should focus on the eight standards of quality education. Eight quality standards of education are: Content, Process, Education and Labor, Infrastructure, Management, Financing of Education, Educational Assessment and Competency. We know that each school has its own characteristics associated with spatial location. and generally the data obtained are non-stationary. Spatial non-stationary is a condition in which a simple global model can not explain the relationship between some set of variables. Of the eight standards, some standards can have a global effect and the other has a local effect on Grad National Exam. Statistical methods can be used to build a model that includes global and local effects Semi Parametric Regression Weighted Geographic (GWR). This method can be used in spatial data mining to large data quality of education in West Java. We estimate global and local effects of the eight standards of quality education at the National Examination and develop strategies to improve the quality of the National Examination school in West Java method using Knowledge Discovery in Databases (KDD) method.

2010 Mathematics Subject Classification: 62J05, 97Q70
Keywords: spatial data mining, quality education, GWR, KDD.

P-11. Small object tracking using adaptive particle filter based on super-resolution

Yabunayya Habibi*, Dwi Ratna Sulistyaningrum, Budi Setiyono
Institut Teknologi Sepuluh Nopember
habibiexebppt@gmail.com, dwiratna@matematka.its.ac.id, masbudisetiyono@gmail.com

Tracking is a problem of estimating the trajectory of an object in the image plane as it moves around a scene. In general, object tracking is a quite complicated problem. Difficulties in object tracking can arise due to object motion, changing appearance patterns, nonrigid object structures, occlusions, and camera motion. Another problem will arise if tracking of moving objects is performed at a long

range, so that a objects appear smaller (small object). Small object has little information in the tracking. If this happen, the tracking will be difficult to identify. In order to overcome these problems, tracking can be integrated with super-resolution. Super-resolution is a process of high-resolution images that are built from a set of subpixel shift with a low-resolution image. This research using tracking of moving object with Adaptive Particle Filter based on super-resolution. Adaptive Particle Filter is an object tracking method which can overcome clutter background cause large ambiguity background, foreground, and occlusion. In addition, super-resolution is used on small object tracking that is difficult to identify, so that tracking of moving object becomes more precise.

2010 Mathematics Subject Classification: 68U10, 94A08, 60G35.
Keywords: adaptive particle filter, small object, super-resolution, tracking.

P-12. The similarity analysis of DNA sequence model based on graph theory and blast program

Y. A. Lesnussa*, S. Kappuw, B. P. Tomasouw
Department of Mathematic, FMIPA, University of Pattimura
yopi_a_lesnussa@yahoo.com, sammykappuw@ymail.com

DNA is a nucleotide acid in form of double helix which contains genetic instruction to determine biology development of all forms of cell's life also it relates with genetic characteristic inheritance. In this research, we will see the similarity of two DNA sequences. DNA sequences that we used are human, orangutan, and gorilla's DNA sequences. The method that we used to analyze the similarity of DNA sequences is Graph Theory. This method started by modeling each DNA sequence into a graph, making its adjacency matrix and a vector for each graph. From these vectors we will determine similarity of two DNA sequences. The similarity of DNA sequences is determined by the similarity level using Cosine, Correlation, and Euclid. Where, the results are showed by the smaller distance, and then show the similarity of two DNA sequences. And then compare the result from Graph Theory with the results of Blast program.

2010 Mathematics Subject Classification: 00A69.
Keywords: DNA sequence, weighted graph, cosine, correlation, Euclid.

P-13. Data mining for classification naming of the village at Java island

Atje Setiawan Abdullah*[1], Akik Hidayat[1], Akmal[1], Deni Setiana[1]
Budi Nurani Ruchjana[2]
[1]Department of Computer Science Universitas Padjadjaran-Indonesia
[2]Department of Mathematics Universitas Padjadjaran-Indonesia
atjesetiawan@gmail.com, akik.hidayat@ymail.com, akmal@unpad.ac.id
{denisetiana, bnurani}@gmail.com

Classification of query based data mining to identify the meaning of the naming of the village in Java island, done by exploring the database village with three categories namely: prefix in the naming of the village, syllables contained in the naming of the village, and full word naming of the village which is actually used. While syllables contained in the naming of the village are classified by the behavior of the culture and character of each province that describes the business, feelings, circumstances, places, nature, respect, plants, fruits, and animals. Sources of data used for the classification of the naming of the village on the island of Java was obtained from Geographical Information Agency (BIG) in the form of a complete village name data with the coordinates in six provinces in Java, which is arranged in a hierarchy of provinces, districts / cities, districts and villages. The research method using KDD (Knowledge Discovery and Database) through the process of preprocessing, data mining and postprocessing to obtain knowledge. In this study, data mining applications to facilitate the search query based on the name of the village, using Java software. While the contours of a map is processed using ArcGIS software. The results of the research can give recommendations to stakeholders such as the Department of Tourism to describe the meaning of the classification of naming the village according to the character in each province at Java island.

2010 Mathematics Subject Classification: 97P70, 97R50
Keywords: classification of naming the village, data mining, database query.

P-14. Air pollution simulation in Baguio City, Philippines using genetic algorithm

Lee Javellana*, Joel Addawe
University of the Philippines Baguio, Baguio City
{ljjavellana, jmaddawe}@up.edu.ph

Baguio City is an urban area approximately 1,540 meters above sea level and located in the northern part of the Philippines. The high altitude city with many air pollution sources contribute most to the air quality deterioration. In this paper, we use the Gaussian plume diffusion formulation to model air quality. The air pollution is then modeled and analyzed using genetic algorithm. We performed numerical experiments to test the performance of the proposed algorithm. Numerical simulations were carried out in deciding the appropriate set of optimized parameter values for the model. The results so far obtained are reported and discussed in this paper.

2010 Mathematics Subject Classification: 11Y16.
Keywords: genetic algorithm, air pollution, optimized parameter.

P-15. Face recognition using moment invariant and neural network

Asep Sholahuddin*, Setiawan Hadi
Departmen of Computer Science, Universitas Padjadjaran
{asep.sholahuddin, setiawanhadi}@unpad.ac.id

Face recognition is one of biometrics and computer vision application that is implemented widely used in the fields of security, robotics and entertainment. The development of face recognition is still facing several problems such as : (i) illumination/lighting, (ii) pose and, (iii) image size. Many methods have been proposed but there is still not satisfactory. This research focussed on a face recognition method based on Moment Invariant (MI) and Neural Network(NN). MI method is known as a method of producing the geometry characteristic of the object that are independent of translation, rotation, and scaling. Experiments has been conducted using data from the AR-database. The datatabase consist of 50 faces basic images which are extended into variational images by cropping, equalizing, resizing, and iluminating. The total images used in this research 450 images. Face image are grouped into two, consist of 150 training images and 300 testing images. this method has been successfully developed by combining moment invariant and neural network.

2010 Mathematics Subject Classification: 65D18.
Keywords: face recognition, moment invariant, neural network.

P-16. Innovation of hypocycloid curves into 3D-hypocs

H. A. Parhusip*[1], M. R. S. Shanti[2]
[1]Mathematics Department, Satya Wacana Christian University
[2]Physics Department, Satya Wacana Christian University
{hanna.arini, made.ray}@staff.uksw.edu

This paper addresses on innovating hypocycloid curves into curves and surfaces called 3D-Hypocs. The innovations are initiated from the used of spherical coordinates. The computational surfaces areas are formulated and some examples are shown. The objective of this work is to present mathematics for non-mathematicians into technical applications such as designing motifs in some objects such as bags, t-shirt, accessories and ornaments promoting mathematics to society easily.

2010 Mathematics Subject Classification: 65D17, 78A55, 00A06.
Keywords: hypocycloid, spherical coordinates, ornaments, surface area.

P-17. Fuzzy C-means inference system for students classification

L. Linawati*, H. A. Parhusip
Mathematics Department of Satya Wacana Christian University
{lilik.linawati, hanna.arini}@staff.uksw.edu

Classification of Indonesian high schools students into 3 classes are shown here,i.e. natural, social and language classes. The studied case is taken by considering the data from the Lab.Christian Senior High School class X in the year 2012/2013 in Salatiga, one of cities in Central Java Province. The used methods are the Fuzzy C-Means (FCM) dan Fuzzy Inference System (FIS) Mamdani. The algorithm FCM is used to have the initial classification. Using the FIS Mamdani method, 180 fuzzy rules are created with students interest, psychological test, and previous academic result as the input variables. The two methods show the errors about 5-6% indicating very good clustering has been obtained.

2010 Mathematics Subject Classification: 03B52, 94D05.
Keywords: clustering, fuzzy-C-means, fuzzy inference system.

P-18. Geographic information systems for mapping the National exam results of junior high school in 2014 at West Java province

Atje Setiawan Abdullah*[1], Juli Rejito[1], Rudi Rosadi[1], Fahmi Candra Permana[1]
I Gede Nyoman Mindra Jaya[2], Budi Nurani Ruchjana[3]
[1]Department of Computer Science, Universitas Padjadjaran, Indonesia
[2]Department of Statistics, Universitas Padjadjaran, Indonesia
[3]Department of Mathematics, Universitas Padjadjaran, Indonesia
{atjesetiawan, jrejito, rudirosadi}@gmail.com, candrapf@yahoo.com
{jay.komang, bnurani}@gmail.com

National Exam level of schooling implemented by the Ministry of Education and Culture for the development of education in Indonesia. The national examinations are centrally evaluated by the National Education Standards Agency, and the expected implementation of the national exams can describe the successful implementation of education at the district, municipal, provincial, or national level. In this study, we evaluate, analyze, and explore the implementation of the national exam database of the results of the Junior High School in 2014, with the SMP / MTs as the smallest unit of analysis at the district level. The method used in this study is a data mining approach using the methodology of Knowledge Discovery in Databases (KDD) using descriptive statistics and spatial mapping of national examinations. The results of the classification of the data mining process to national exams in 2014 using the 6,878 SMP / MTs in West Java showed that 81.01% were at moderate levels. While the results of the spatial mapping for SMP / MTs in West Java can be explained 36,99% at the unfavorable level. The evaluation results visualization in graphs is done using ArcGIS to provide position information quality of education in municipal, provincial or national level. The results of this

study can be used by management to make decisions improve educational services based on the national exam database in West Java.

2010 Mathematics Subject Classification: 97Q70
Keywords: KDD, spatial mapping, national exam.

P-19. Computation and simulation of fluid flow during retinal detachment

Lim Yeou Jiann*[1], Zuhaila Ismail[1], Sharidan Shafie[1], Alistair Fitt[2]
[1]Department of Mathematical Sciences, Universiti Teknologi Malaysia
[2]Fac. of Technology, Oxford Brookes Univ. Headington Campus, United Kingdom
jiann8807@gmail.com, {zuhaila, sharidan}@utm.my, afitt@brookes.ac.uk

In this paper, a phenomenon of fluid flow through a detached retina is studied. Retinal detachment often develops in eyes once there is a retinal tear or hole. This allows the liquefied vitreous humour to seep underneath. The vitreous humour will then start to push the retinal away from the underlying tissue, ultimately causing impairment or even loss of vision. In order to study the fluid flow through the detached retina, a mathematical model is developed by considering the fluid flow in a channel with one moving wall and one stationary wall. Using finite element analysis, the flow behaviour during the detached retina is analysed. As a comparison with the obtained numerical results, a numerical simulation is carried out using COMSOL. The study shows that the numerical results obtained are greatly agreement with the simulation determined in COMSOL. The behaviour of the vitreous humour flow in the human eye do affected by the detached retina.

2010 Mathematics Subject Classification: 76Z99, 76D05, 65N30.
Keywords: retinal detachment, finite element method, COMSOL.

P-20. Image indexing using color histogram and K-means clustering for optimization CBIR in image database

Juli Rejito*[1], Atje Setiawan Abdullah[1], Akmal[1], Deni Setiana[1], Budi N. Ruchjana[2]
[1]Department of Computer Science, Universitas Padjadjaran, Indonesia
[2]Department of Mathematics, Universitas Padjadjaran, Indonesia
{jrejito, atjesetiawan}@gmail.com, akmal@unpad.ac.id, {denisetiana, bnurani}@gmail.com

Retrieving visually similar images from image database needs high speed and accuracy. Various text and content based image retrieval techniques are being investigated by the researchers in order to exactly match the image features. The proposed technique deals with Content Based Image Retrieval (CBIR) system by applying various image feature detection and matching techniques to investigate the retrieving efficiency of the image. The newness in the proposed research is that it extracts image features with color histograms and K-means clustering for index image database. The accuracy and performance related issues listed in the previous works are overcome while the database images grow. The results obtained by the proposed system obviously confirm that partitioning of image objects helps

in optimization retrieving of similar images from the database. The proposed CBIR method is compared with our previously existed methodologies and found better in the retrieval accuracy. The retrieval time and accuracy are comparatively good than previous works proposed in CBIR system.

2010 Mathematics Subject Classification: 62H35, 68U10, 94A08
Keywords: CBIR, image features, color histogram, K-means clustering.

P-21. Some steganography methods for National maritime security

R Bisma Ramadhan*[1], Edy Tri Baskoro[1], Prima Roza[2]
[1]Combinatorial Mathematics Research Group, Institut Teknologi Bandung
[2]Social Sciences and Humanities Research Group, Institut Teknologi Bandung
rbisma.ramadhan@gmail.com, ebaskoro@math.itb.ac.id, primaitb@yahoo.com

Indonesia is a huge archipelagic state with a very vast territorial waters. Therefore, a tremendous effort is needed to ensure the Indonesian maritime security and safety. The Indonesian Maritime Security Agency (BAKAMLA RI) is the leader institution assigned by the law responsible for this purpose. In its operation BAKAMLA RI works coordinatingly with other related institutions. All the information, and communication language used by BAKAMLA RI with its stakeholder institutions during the operation for ensuring the maritime security should be highly secured. For this reason, the methods used in securing all the informations are very crucial. In this paper, we propose new methods of steganography for embedding information such as text or image into random images for the use of National Maritime Security. These methods are based on modification RGB property of images.

2010 Mathematics Subject Classification: 94A60
Keywords: steganography, cryptography, maritime security.

P-22. Estimation of total loss and damage insurance premiums which causes the Citarum river flooding in south Bandung region Indonesia

Pramono Sidi*[1], Mustafa Mamat[2], Sukono[3], Sudradjat Supian[3]
[1]Department of Mathematics, Universitas Terbuka
[2]Graduate School, Universiti Sultan Zainal Abidin, Malaysia
[3]Department of Mathematics, Universitas Padjadjaran
pramsidi@yahoo.co.id, must@unisza.edu.my, {fsukono, adjat03}@yahoo.com

In this paper intends to discuss estimation of total loss and damage insurance premiums which causes the Citarum River flooding in South Bandung region, Indonesia. Citarum river floods often cause great damage and loss for residents, particularly those living in South Bandung region. To repair the damage requires no small cost, so it requires a multi-source funding from various parties. One alternative sources of funding allows is from insurance companies, especially flood insurance. Associated with the flood insurance, it is necessary to estimation of the

amount of damages as the basis to determine the amount of compensation, and the calculation of the amount of premium to be borne by the participants of flood insurance. In this paper, to estimate the total losses we did by using multiple linear regression models. While the insurance premium is estimated referring to the model of the National Catastrophe Insurance Fund (NCIF) expanded. NCIF expanded model is based on the average income, average spending, and the value of assets insured. The results of the discussion showed that by using one of the alternative flood insurance, can reduce the burden of funding repairs of flood damage.

2010 Mathematics Subject Classification: 62P05.
Keywords: linear regression, flood insurance, average income, average spending, and the value of assets insured.

P-23. Computational study of electrical activities in subthalamic nucleus neuron: role of T-type calcium channel in Parkinson's disease

Chitaranjan Mahapatra*, Rohit Manchanda
Indian Institute of Technology Bombay
cmahapatra97@gmail.com, rmanch@iitb.ac.in

The pathological hallmark of the Parkinson's disease (PD) is loss of dopaminergic input to the striatum and emergence of abnormal burst discharge in the STN cells. As calcium ion channels play dominant role in generating burst discharges, quantitative analysis of those ion channels effect in subthalamic nucleus (STN) cells will be the key to pharmacological assessment. Here our goal is to establish a mathematical platform with sufficient biophysical details to study the effect of T type Ca2+ channel in bursting patterns of STN. The cell membrane is described as an equivalent electrical circuit consisting of a membrane capacitance connected in parallel with a number of variable conductances representing the ion channels. The passive and active properties of multi compartmental STN cell are extracted from electrophysiological data in various experiments. The mathematical models for nine ionic currents in STN cells are described by differential equations, in terms of maximal conductances, electro chemical gradients, and voltage-dependent activation/inactivation gating variables. Some ionic channel parameters are borrowed from previous model. T-type Ca2+ currents those were modelled with parameters borrowed from experimental result. The STN cell fires action potentials (AP) in the single spike mode with a resting membrane potential (RMP) of approximately -50 mV. A hyperpolarizing current injection of -0.35 nA changes to the burst mode of firing when the RMP is approximately -65 mV. The rhythmic bursting firing exhibited in the model (5-15 Hz) is critically dependent on the persistent sodium channel and hyperpolarization activated currents. The AP peak amplitude range is of 80mV, threshold of -48mV and after hyperpolarization amplitude of 15mV. The half-height width in the model is 0.75 ms. These are consistent with the findings in experiments. The T-type Ca2+ currents channels bring the oscillatory pattern into a positive feedback cycle, where the AP plateau built up by Ca2+ conductances,

until enough slowly activated K+ channels are open to end the burst. Moreover, the same T-type Ca2+ channel with zero conductances abolished burst firings in STN model and relatively low conductance abolishes the initial rising phase of the burst plateau and then shortens the burst duration. The essential role of T-type Ca2+ currents in the genesis of burst discharges has been established in this silico STN model. These studies points towards proper dosing of T-type calcium channel inhibitors as an effective new non-dopaminergic alternative in parkinsonian patients.

2010 Mathematics Subject Classification: 00A71.

Keywords: Parkinson disease, mathematical modeling, bursting pattern.

P-24. Correcting circular non-uniform illumination of Sundanese ethnoimage

S. Hadi*, M. Suryani, A. K. Supriatna
Universitas Padjadjaran
{setiawanhadi, mira.suryani, aksupriatna}@unpad.ac.id

Ancient manuscripts can be considered as a very important and valuable documents, not only in the sense of cultural heritage, but also as part of ethnocultural documents and country intellectual properties. On one hand, some documents are treated and maintained properly. On the other hand, they are badly stored in a place that are rarely attended and on poor condition. In facts, ancient documents, which are written on palm leaves called lontar, can consist of important data or information that might be related to our modern culture and daily life. It is not impossible that some documents can explain mathematical theories or computing methods that have not been solved today. Efforts have been performed to preserve those documents by digitizing them into digital images and then do some indexation and other intelligent approach to detect and recognize information consisted in the images. However, in acquisition step, some images are not taken properly which can cause problems for the next step of processing. These images are taken using camera with bad light condition and are captured in uncontrolled environment, so the intensity distribution of images are not uniform and showed ellipse-like shape. In this paper we proposed a new image processing method to normalize the intensity distribution of ancient Sundanese manuscript degraded digital images. The algorithm, which has been successfully developed by synthesizing Gaussian-based function and optimizing to handle the aforementioned illumination problems, can be described as:

$$g(x) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)$$

followed by thresholding process based on two methods, empirical method and Chebyshev theorem. $\sigma_w^2(t) = \omega_1(t)\sigma_1^2(t) + \omega_2(t)\sigma_2^2(t)$The minimization of the variance is same with the maximization of the class, as presented below: $\sigma_b^2(t) = \sigma^2 - \sigma_w^2(t) = \omega_1(t)\omega_2(t)(\mu_1(t) - \mu_2(t))^2$The maximum value of $\sigma_b^2(t)$ is the optimal value of thresholding. The experiment has been conducted by involving 12

Sundanese ethnoimages, written in the period of 15th century. The result showed that our algorithm can solve for about 95% of circular non-uniform illumination problem of Sundanese ethnoimages.

2010 Mathematics Subject Classification: 68U10, 94A08, 65D18.
Keywords: ancient, correction, ethnoimage, illumination, manuscript, Sundanese.

P-25. Sundanese ancient manuscripts search engine using probabilistic approach

Mira Suryani*, Setiawan Hadi
Computer Science Department, Universitas Padjadjaran
{mira.suryani, setiawanhadi}@unpad.ac.id

Indonesia as one of the Southeast Asian country has many ancient manuscripts that are written in different traditional languages such as Sundanese, Javanese, Balinese, and etc. Especially in West Java, the ancient manuscripts were written in Sundanese. Many of the manuscripts are in damage condition due to lack of maintenance, injuries of time (dirt, moisture, insects), and accidents (fire, floods). If the manuscripts not preserve as fast as we can, the knowledge on the manuscripts will be lost and also the Sundanese tradition will be lost too. The condition aforementioned also makes the information hard to search. On the other hand, the development of information technology both in terms of hardware and software has been growing rapidly. A search for information using Information and Communication Technology (ICT) has become a regular thing for the community. So in order to preserve the information in Sundanese ancient manuscripts and make them easier to search, a search engine has been developed. The search engine must have good computing ability. In order to get the best computation in developed search engine, three types of probabilistic approaches: Bayesian Networks Model, Divergence from Randomness, and PL2F as derivative form Divergence from Random- ness have been compared in this study. The three probabilistic approaches supported by index of documents and three different weighting methods: term occurrence, term frequency, and TF-IDF. The experiment involved 12 Sundanese ancient manuscripts. From 12 manuscripts there are 474 distinct terms. The developed search engine tested by 474 single queries and combination of two and three terms from 474 terms for multiple queries. The experiment results showed that for the single query and multiple query, the best searching performance given by the combination of PL2F approach and TF-IDF weighting method. The performance has been evaluated by query latency and Mean Average Precision (MAP). The best performance happened because the TF-IDF is used to reduce the query dimension and the PL2F approach gives a fast computation.

2010 Mathematics Subject Classification: 68P20, 68U15.
Keywords: ancient manuscript, probabilistic approach, search engine, sundanese.

P-26. Preliminary study on binarization methods of ancient Sundanese - manuscript images

Erick Paulus*, Mira Suryani, Setiawan Hadi
Computer Science Department, Universitas Padjadjaran
{erick.paulus, mira.suryani, setiawanhadi@unpad.ac.id

The ancient Sundanese manuscript is one of the notable historical document in West Java that contain various wisdom, artwork, and story of social life in the past. Government, organization, and private collector tried to preserve this historical document by digitizing the manuscript. The digitized images have some characteristics such as different contrast, irregular intensity distribution, shadow, and stain due to difference of tools and conditions such as camera and lighting. In order to extract text and relevant information, we can use image binarization as preprocessing step. This paper presents the experimental study of various existing binarization methods and compare their measurements to various ancient Sundanese manuscripts. Beside common binarization methods (Otsu, Niblack, Sauvola, Bernsen), this study use any specific method to deal with irregular intensity distribution such as Narrow Gaussian Block. The aim is to get the foundation of binarization method to build a framework of an efficient preprocessing technique for ancient manuscript recognition. The method has been tested on 20 Lontar from different characteristics of ancient Sundanese manuscripts and evaluated by F-Measure. The result show that common binarization methods is relatively work for regular intensity distribution, stain and good contrast. Narrow Gaussian Block can increase performance of the common binarization methods to handle irregular intensity distribution and low contrast.

2010 Mathematics Subject Classification: 68P20, 68U15.
Keywords: ancient manuscript, binarization method, historical document, Sundanese.

P-27. Intelligent communication language for the Indonesian maritime security

Prima Roza*[1], Tri Sulistyaningtyas[1], A. Wawan Jatnika[1], Edy Tri Baskoro[2]
[1]Social Sciences and Humanities Research Group, Institut Teknologi Bandung
[2]Combinatorial Mathematics Research Group, Institut Teknologi Bandung
primaitb@yahoo.com, trining_ism@yahoo.co.id, aswan_jatnika@yahoo.com
ebaskoro@math.itb.ac.id

Indonesia is an archipelago which consists of lands and territorial waters. The vast country consists of 17,504 islands surrounded by waters of the territorial sea and exclusive economic zone covering an area of 6.1 million km2. The territorial waters cover two-thirds of the existing area. The sea has a very important meaning for the country, such as for unifying the nation, as the means of transportation and communication, as the source of natural resources, and as a medium for the security defences. The threats to the maritime security consist of two: symmetric threats;

such as smuggling, illegal fishing, robbery (sea and armed robbery), piracy, and the stealing of the marine resources, and asymmetric threats; such as the threats made by radical non-state groups. Therefore, the security and safety of the Indonesian maritime is very important for the continuity of its life and sovereignty. Bakamla RI as the National Maritime Security Information Center, as well as the Indonesian Sea and Coast Guard, together with its stakeholders, is responsible for the security and safety of the Indonesian waters. In this paper we propose a cryptographic method to improve the intelligence communication language between Bakamla and its stakeholders used during its operations to ensure the Indonesian maritime security.

2010 Mathematics Subject Classification: 94A60.
Keywords: maritime security, cryptography.

P-28. Computing arbitrary real powers of a matrix by using number representation system

Yeon-Ji Kim*[1], Jong-Hyeon Seo[2], Hyun-Min Kim[1]
[1]Pusan National University, [2]Dongseo University
{yeonjikim, hyeonni94, hyunmin}@pusan.ac.kr

We present a new algorithm for approximating arbitrary real powers A of a complex square matrix A only using binary number representation and the matrix square root algorithm. We also derive a version of the extended algorithm that combine the Schur decomposition. Our numerical experiments show similar accuracy as compared to existing methods.

2010 Mathematics Subject Classification: 65F30.
Keywords: matrix real power, matrix p-th root, matrix square root, circular binary decimal number representation, number representation system, Schur decomposition.

P-29. Stiffness detection technique for selecting adaptive step size in the parareal algorithm

Sunyoung Bu
Department of Liberal Arts and Science, Hongik University, Korea
syboo@hongik.ac.kr

A practical strategy is constructed to select an adaptive step size for solving stiff initial value problem in the parareal framework. For this, we propose a technique to detect stiffness of a given system and its solutions since the time step size can be chosen according to the extent of stiffness. Numerical experiments demonstrate the theoretical results.

2010 Mathematics Subject Classification: 65L04, 65L05, 65Y05.
Keywords: stiffness, Initial value problems, parareal method.

P-30. Newton's method to solve a matrix equation with monotonicity

Young-Jin Kim, Geon-Woo Kim*, Hyun-Min Kim
Pusan National University
kyj2806@gmail.com, rrtl369@naver.com, hyunmin@pusan.ac.kr

In this paper, we consider the matrix equation $\mathcal{F}(X) = X + (B + X)^{-1}C = 0$ transformed from the quadratic matrix equation (QME) $Q(X) = AX^2 + BX + C = 0$. To find a solution of this equation numerically, we exploit the Newton's method. Already, the local convergence of the matrix sequence was proved to the primary solvent but without monotonicity. We also suggest some sufficient conditions for monotonicity of our iteration sequence, and prove the monotone convergence. Moreover, we prove a theorem that means the modified Newton's method is better than pure Newton's method. We finally give some examples related to the benefits of this method.

2010 Mathematics Subject Classification: 65H10.
Keywords: quadratic matrix equation, M-matrix, Newton's method, monotonicity.

P-31. An iterative method with stepsize parameter for solving nonlinear matrix equations

Jie Meng*, Hyun-Min Kim
Pusan National University
mengjiehw@163.com, hyunmin@pusan.ac.kr

We consider two nonlinear matrix equations $X^p + A^*XA = Q$ and $X^p - A^*X^{-1}A = Q$, where p is a positive integer, A is an arbitrary $n \times n$ matrix, and Q is a Hermitian positive definite matrix. A fixed-point iteration with stepsize parameter for obtaining the Hermitian positive definite solutions of these two matrix equations is proposed. The proposed iterative method is compared with the already existing fixed-point iterative methods. Several numerical examples are presented to show that the proposed iterative method with proper stepsize parameter reduce the number of iterations and CPU time significantly.

2010 Mathematics Subject Classification: 15A24, 65F10, 65H10.
Keywords: matrix equation, hermitian positive definite, fixed-point iteration, coupled fixed-point theorem.

P-32. Multicollsion attack on CBC-MAC, EMAC, and XCBC-MAC of AES-128 algorithm

Alfonso Brolin Sihite*, Bety Hayat Susanti
Sekolah Tinggi Sandi Negara
alfonso.brolin.s.17@gmail.com, bety.hayat@mail.lemsaneg.go.id

A Message Authentication Codes (MAC) can be constructed based on a block cipher algorithm. CBC-MAC, EMAC, and XCBC-MAC constructions are some of MAC schemes that used in the hash function. In this paper, we do multicollision attack on CBC-MAC, EMAC, and XCBC-MAC construction which uses AES-128 block cipher algorithm as basic construction. The method of multicollision attack utilizes the concept of existential forgery on CBC-MAC. The results show that the multicollision can be obtained easily in CBC-MAC, EMAC, and XCBC-MAC construction.

2010 Mathematics Subject Classification: 11Y16.
Keywords: AES, CBC-MAC, EMAC, existential forgery, hash function, multicollision attack, XCBC-MAC.

P-33. On the construction of L_2 orthogonal elements of arbitrary order for local projection stabilization

Friedhelm Schieweck[1], Piotr Skrzypacz[2], Lutz Tobiska[1]
[1]Otto von Guericke University of Magdeburg, Germany
[2]Nazarbayev University, Astana, Kazakhstan
schiewec@ovgu.de, piotr.skrzypacz@nu.edu.kz, email: tobiska@ovgu.de

Based on the results from Schieweck and Skrzypacz (2012), we construct L_2 orthogonal conforming elements of arbitrary order for the Local Projection Scheme (LPS). The stabilizing additive term in the LPS discrete bilinear form is chosen as the appropriate sum of artificial diffusion parts applied only to the small scale modes of the finite element functions. The proposed L_2 orthogonal basis functions of the ansatz space lead to a diagonal mass matrix which is an undisputable advantage for time discretizations. We prove that the constructed family of finite elements satisfies a local inf-sup condition

$$\exists \beta_r > 0 : \quad \inf_{q_h \in D_r(K)} \sup_{v_h \in B_r(K)} \frac{(v_h, q_h)_K}{\|v_h\|_{0,K} \, \|q_h\|_{0,K}} \geq \beta_r \qquad \forall \, K \in \mathcal{T}_h,$$

where $B_r(K)$ is the local space of the element bubble functions and $D_r(K)$ is the local part of the discoutinuous finite element space, cf. Matthies, Skrzypacz and Tobiska (2007). Additionally, we determine the size of the local inf-sup constant β_r in terms of the polynomial degree. Our numerical tests show that the discrete solution is oscillation-free and of optimal accuracy in the regions away from the boundary layer.

2010 Mathematics Subject Classification: 65N12, 65N30, 65M60.

Keywords: stabilized finite elements, L_2 orthogonal elements, convection-diffusion

P-34. Derivative estimation of triangular patch by using moving least square

Noorehan Awang*[1], Rahmita Wirza Rahmat[2]
[1]Faculty of Comp. Science and Information Technology, University Putra Malaysia
[2]Faculty of Comp. and Mathematical Sciences, Universiti Teknologi MARA
gs43550@student.upm.edu.my, rahmita@fsktm.upm.edu.my

Surface reconstruction of scattered data requires a definition of a surface which passes all the control point and triangular patch is one of the technique use where the control points become the vertices of the triangles. In order to get a smooth surface, overall triangular surface should be connected with tangential continuity, or continuity. In order to get the continuous surface, the first-order partial derivatives at the vertices of the triangles need to be defined for all data points. The common method use to estimate partial derivatives was the least square method. Although the least squares method is easy to understand but the curve do not pass all the control point. Therefore this paper intend to improve the derivative estimation by using moving least squares (MLS) for derivative estimation for the triangular patch constructed. MLS interpolates the original data and guarantee that the reconstructed patches smoothly blend into the original surface. The research was using a test data points which were triangulated using Delaunay triangulation method and the partial derivatives for both method was constructed for all data points. The results of the research shows that MLS achieved higher accuracy and the curves pass all control points compared to the least square method.

2010 Mathematics Subject Classification: 93E24, 32B25, 14J29 .
Keywords: surface reconstruction, Delaunay triangulation, least square, moving least square.

P-35. SIMON-64, SPECK-64 and SIMECK-64 as Pseudo Random Number Generator with NIST Test

Sofu Risqi Y.S, Susila Windarta
National Crypto Institute
sofurizky@yahoo.com, susila.windarta@stsn-nci.ac.id

SIMON, SPECK and SIMECK lightweight block cipher are claimed more efficient than PRESENT, CLEVIA, KATAN. Lightweight block cipher is fast to generate pseudo random bit sequences. In this paper we give a comparison between PRNG of SIMON-64, SPECK-64 and SIMECK-64 in PGV-5 scheme using the NIST randomness sts-2.1.1 which consist of 15 tests. We generate 1.000 sequences that consist of 1.000.000 bit and a sequence passes statistical tests if p-value $\geq$ 0.01.According to the result, PRNG of SIMON-64 and SIMECK-64 pass all of test but SPECK-64 does not pass Random Excursions test.

2010 Mathematics Subject Classification: 03B70.
Keywords: SIMON, SPECK, SIMECK, NIST Test.

P-36. A brief comparison between SIMON-32, SPECK-32 and SIMECK-32 with collision test

Sofu Risqi Y.S, Susila Windarta
National Crypto Institute
sofurizky@yahoo.com, susila.windarta@stsn-nci.ac.id

SIMECK is a new lightweight block cipher design based on the combination of SIMON and SPECK block cipher. While the design allows a smaller and more efficient hardware implementation, its security margins are not well understood. The lack of design rationals of its predecessors further leaves some uncertainty on the security of SIMECK. In this work we give a short analysis of comparison based on collision test between SIMON-32, SPECK-32 and SIMECK-32 using 2^{20} random sample and 4096 input change that is generated from a random sample. We can obtain the p-value of SIMON-32, SPECK-32 and SIMECK-32 that are 3.49719E-58, 0.912115, and 0. The p-value of SIMON-32 and SIMECK-32 algorithm are less than α (p-value $< 0,01$) so SIMON-32 and SIMECK32 are not a random mapping based on collision test. While the p-value of SPECK-32 is more than α (p-value $> 0,01$), SPECK-32 is a random mapping based on collision test.

2010 Mathematics Subject Classification: 03D32.
Keywords: SIMON, SPECK, SIMECK, collision test.

P-37. Correlation of M-equivalence and Strong M-equivalence for Parikh Matrices

Ghajendran Poovanandran*, Wen Chean Teh
School of Mathematical Sciences, Universiti Sains Malaysia
p.ghajendran@gmail.com, dasmenteh@usm.my

The introduction of Parikh matrices by Mateescu and others in 2001 is a more informative alternative to Parikh vectors in arithmetizing words by numbers. Two words are said to be M-equivalent if and only if they share the same Parikh matrix. Until now, even for the case of ternary alphabet, finding a complete characterization of M-equivalent words remains as an open problem. The claim that ME-equivalence characterizes M-equivalence was refuted by Serbănută with a counterexample. As an improvement, new rewritting rules have been proposed by Atanasiu to provide characterization of M-equivalence for a restricted class of ternary words. Meanwhile, the notion of strong M-equivalence was introduced recently as an order-independent alternative to the classical M-equivalence. We observe that the pair of words in Serbănută's counterexample is not only M-equivalent, but strongly M-equivalent as well. In this paper, we further study the notion of M-equivalence, strong M-equivalence, and the interrelation between them. In particular, a scheme to generate ternary M-equivalent words that are not ME-equivalent of certain prescribed complexity will be presented. An exhaustive

characterization of strongly M-equivalent words is developed, along with the introduction of a wider class of rewritting rules, namely strict $(2 \cdot t)$ transformation. These new rewritting rules are able to characterize strong M-equivalence for a larger class of ternary words, including the historical counter-example. This transformation is then used to generate ternary words that are strongly M-equivalent but not MSE-equivalent.

2010 Mathematics Subject Classification: 68R15, 68Q45, 05A05.
Keywords: parikh matrices, injectivity problem, M-equivalence, strong M-equivalence.

P-38. The implementation of k-means partitioning algorithm in HOPACH clustering method

K. R. Adzima*, A. Bustamam, D. Aldila
Department of Mathematics, Universitas Indonesia
{khaola.rachma, alhadi, aldiladipo}@sci.ui.ac.id

Hierarchical Ordered Partitioning And Collapsing Hybrid (HOPACH) is one of the powerful clustering method which combining the strengths of partitioning and agglomerative clustering methods. Several partition clustering methods such as PAM, k-Means, SOM, or other partitioning algorithms can be used in the partitioning process. This process is followed by the ordering steps, then continued with the agglomorative process. The number of main clusters determine by MSS (Mean Split Silhouette) value. MSS is used to measure the heterogeneity of the clustering result. The lower the MSS value the more homogeniety each cluster members. We select the number of clusters from the clustering results with minimum MSS. In this implementation, we incorporate k-Means partitioning algorithm in this HOPACH clustering method, to cluster and analyze 136 DNA sequences of Ebola viruses. The clustering process is started with collecting DNA sequences of Ebola viruses from GenBank, then performing features extraction of these DNA sequences using n-mers frequency. The extraction results are collected as a features matrix and normalized using the min-max normalization with interval [0, 1] as an input data. As the results, we obtained 8 clusters with minimum MSS (Mean Split Silhouette) 0.50266. The clustering process in this article is using the open source program R.

2010 Mathematics Subject Classification: 62P10, 62H30, 91C20, 92B15.
Keywords: clustering, HOPACH, k-means, MSS, partitioning.

P-39. The implementation of self organizing maps (SOM) partitioning algorithm in HOPACH clustering method

S. Wulandari*, A. Bustamam, T. Siswantining
Department of Mathematics, Universitas Indonesia
{septian.wulandari, alhadi, titin}@sci.ui.ac.id

Since the discovery of DNA structure in form of double helix, there are more development in method to understand the more complex interaction involving DNA

such as DNA clustering. DNA Clustering can be used to find the clusters of DNA that might have the same features or functions. DNA clustering can be done by applying partitional or hierarchical method. Those two methods can be combined by doing partitional and hierarchical stage alternately known as HOPACH clustering. In partitional stage, several algorithm can be used including SOM, PAM, and k-Means, and others. In this study, we apply SOM algorithm since it uses unsupervised learning method and efficient to be used for large data. The partitional process is continued by ordering process and then performed hierarchical proses by collapsing with agglomerative process to produce more acurate clustering results. To determine the number of main clusters, we calculate the homogeneous value of the clustering results using MSS (Mean Split Silhouette) value. The criteria of the main cluster is the smallest MSS value of the clustering results. In this study, the dataset consists of 136 sequences of DNA EVD (Ebola Virus Disease) obtained from NCBI GenBank. We use the features extraction of DNA sequence using n-mers frequency to compute the features matrix. Furthermore, we normalize the features matrix using min-max normalization, and then calculating the genetic distance using Euclidean Distance. Genetic distance matrix can be used as a basis to do partitioning process in SOM partitioning algorithm in HOPACH clustering method. We develop the features extraction of DNA sequence, normalization, and the implementation of SOM partitioning algorithm for this HOPACH clustering method using open source program R. As the result we found 9 clusters with MSS value of 0,50280. The cluster results can be identified according to species and the first year of the virus becoming an epidemic.

2010 Mathematics Subject Classification: 62P10, 62H30, 91C20, 92B15.
Keywords: clustering, HOPACH, MSS, SOM, R programming.

P-40. Strict avalanche criterion (SAC) test on KLEIN, L-BLOCK and PRESENT algorithms

Sofyan Reza Ferianto*, Rizki Anisa Riyanti, Annisa Dini Handayani
Sekolah Tinggi Sandi Negara
{1211100946, 1211100941}@student.stsn-nci.ac.id, annisa.dini@stsn-nci.ac.id

Diffusion and confusion are the most important things in block ciphers, so each of lightweight block ciphers must be tested by cryptographic randomness tests. Strict Avalanche Criterion (SAC) Test is desirable property of block cipher, including lightweight block cipher. SAC is recommended by Fatih Sulak for testing the cryptographic randomness on Block Cipher and Hash Function. In this paper, SAC Test is applied on some lightweight block cipher, like KLEIN, L-BLOCK, and PRESENT. Based on 1-bit avalanche of data sets, the randomness of KLEIN, L-BLOCK, and PRESENT achieved after 1, 3 and 3 round respectively. Based on 8-bit avalanche of data sets, the randomness of KLEIN, L-BLOCK, and PRESENT achieved after 1, 3 and 4 round respectively. Based on message rotation of data sets, the randomness of KLEIN, L-BLOCK, and PRESENT achieved after 1, 2

and 1 round respectively. This paper shows that KLEIN has better randomness than L-BLOCK and PRESENT.

2010 Mathematics Subject Classification: 68Q25.
Keywords: L-BLOCK, PRESENT algorithms.

P-41. Quadratic Investment Portfolio without A Risk-Free Asset Based On Value-At-Risk

Sukono*, Sudradjat Supian, Dwi Susanti
Department of Mathematics, Universitas Padjadjaran
{fsukono, adjat03, dwi_susanti65}@yahoo.com

This paper intends to discuss the issue of quadratic investment portfolio without a risk-free asset based on Value-at-Risk. It is assumed that the risk of the investment portfolio is measured by Value-at-Risk. The completion of the problems include: First, formulate models of trade-off problem. Second, formulate models of maximization of expectation problem. Third, formulate models of minimization of Value-at-Risk problem. As a numerical illustration, this paper also analyzed some of the stocks traded on the capital market in Indonesia. Based on the results of the discussion can be concluded that, the trade-off between risk and expected return does not only depend on the type of investor but also on the size of the investment. In a realistic investment situation, it is likely that more constraints, e.g., restriction on short-selling, need to be considered.

2010 Mathematics Subject Classification: 62P05.
Keywords: investment portfolio, value-at-risk, short-selling, maximization, minimization.

P-42. A Comparison of Kernel Logistic Regression and Backpropagation Neural Networks in Prediction of Financial Distress

Riska Yanu Fa'rifah, Bobby Poerwanto*, Feri Padli
University of Cokroaminoto Palopo
riska.yanu@gmail.com, Bobbypoerwanto@uncp.ac.id, ferypadli@uncp.ac.id

Financial distress is a condition where the company experienced financial condition declined continuously for several years. If financial distress cannot be relieved, it can lead to bankruptcy. The analysis that can be used to prevent a bankruptcy in the business and provide early warning information to determine the condition of companies experiencing financial distress is the method of classification. Kernel logistic regression (KLR) is one of classification method for binary data sets that can provide high classification accuracy of the small to medium size data sets with high dimension. Other classification methods for binary data sets with high accuracy is backpropagation neural networks (RBNN). Both of these methods will be used to predict financial distress of 42 companies in Indonesia in the year 2009 to 2013 and the results will be compared. In this study the predictors are the size of the audit committee (X1), the frequency of audit committee meetings (X2), the

proportion of independent audit committees (X3), the size of the board of directors (X4), the size of the board of commissioners (X5), managerial ownership (X6), and institutional ownership (X7). The analysis showed that the backpropagation neural networks provides higher accuracy than KLR, 92.86% for all variables and 90.48% for the significant variables. The significant variables are the size of the audit committee (X1), the frequency of audit committee meetings (X2), the size of the board of commissioners (X5), and institutional ownership (X7).

2010 Mathematics Subject Classification: 62M45, 68N15.
Keywords: backpropagation neural networks, financial distress, kernel logistic regression.

P-43. Mathematical analysis of large scale cyber attacks: cyber war

Apeksha Prajapati*, Bimal Kumar Mishra
Birla Institute of Technology, Mesra, Ranchi, India 835 215
{prajapatiapeksha, drbimalmishra}@gmail.com

This paper presents modeling large scale attacks against computer network. We propose three mathematical models on cyber war based on the complexity. We have developed three linear mathematical models by considering rate of change of war potential. The term war potential is defined as the capacity to wage war by any nation. We relate war potential with defense strategies implemented by nations, loss of resources during war and offensive information. The first model is the simplest mathematical model which explains the association between the rate of change of war potential and defense policies implemented by the nations. The second model confers the role of cyber resources in the nations' war potentials. Comparison leads to better understanding, so comparative results are also discussed for prior and past cyber war scenario. The third model analyses the role of offensive information which basically explains the intensity of cyber war in terms of offensive information. The stability analysis of the models is also discussed and an attempt has been made to relate and explore the idea of stability analysis with balance of power condition of the nations'. Furthermore, we discuss different condition at which cyber war can be controlled. Extensive Simulations using Matlab are also done to understand the state of balance of power situation achieved by participating nations in cyber war and its significance. The mathematical analysis of cyber war with three different models provides idea, assumption, applications, and features to understand the role of war potential, cyber resources and offensive information in cyber war.

2010 Mathematics Subject Classification: 34M03, 93A30, 81T80.
Keywords: cyber war, mathematical modeling, stability analysis, state of balance of power.

P-44. Some variant of Newton method with higher order convergence

Jivandhar Jnawali*, Chet Raj Bhatta
Central Department of Mathematics, Tribhuvan University, Kathmandu, Nepal
{jnawalij, chetbhatta0}@gmail.com

Based on Newton method for solving nonlinear equations, McDaugall and Wotherspoon recently modified this method in predictor-corrector form and accelerate the order of convergence from 2 to $1+\sqrt{2}$. Inspired by this result, we derive some variant of Newton method for solving nonlinear equations having order of convergence 5:1925. Also we derive hybrid methods combining our own methods and the standard secant method. The resulting methods turn out to be the order of convergence 7:275. Finally, numerical examples are given to demonstrate the performance of the developed method.

2010 Mathematics Subject Classification: 65H05.
Keywords:Newton method, secant method, predictor-corrector method, nonlinear equations, order of convergence.

P-45. Expected profit from revenue earning asset in a fishery industry with different environmental conditions

Hennie Husniah*[1], Asep K. Supriatna[2]
[1]Dept. Industrial Engineering, Langlangbuana University
[2]Dept. Mathematics, Padjadjaran University
hennie.husniah@gmail.com, a.k.supriatna@unpad.ac.id

The paper presents a mathematical model on the calculation of expected profit for a company dealing in a fishery Industry. We assume the company owns an industrial asset, such as a fishing vessel, which is operated to earn the profit. We consider two major issues or point of views in the fishery industry, profit to the operator and sustainability of the fish stock. From the first point of view, one aspect that might affect the expected profit is the availability of the asset, since profit only occur when the asset is available to operate. Considering this vital role of the asset availability, a good maintenance strategy to the asset is necessary to assure its availability when it is needed. In this paper we propose a mathematical model to find the expected profit by considering imperfect maintenance strategy. We assume the vessel is used for various environmental conditions. This different usage of the asset is model through Markov process to obtain the expected number of failure. This expected number will affect the maintenance strategy which eventually determine the profit earn by the company. From the second point of view, we consider the sustainability of the commercial fish stock by applying the concept of sustainable maximum yield (MSY). There are several models of MSY in fishery literature. In this paper we combine the result from the first point of view with various MSY to look at the sensitivity of the resulting profit to different usage of the MSY. This will facilitate a prudent choice in the application of the theory in the real case.

2010 Mathematics Subject Classification: 60J25, 62P30, 91B76, 92D25.
Keywords: imperfect maintenance, fishing vessel, maximum sustainable yield, profit maximization.

P-46. A new variant of deletion in languages: computed sequential deletion

Ahmad Firdaus Yosman*[1], Fong Wan Heng[1], Sherzod Turaev[2], Nor Haniza Sarmin[1]
[1]Department of Mathematical Sciences, Universiti Teknologi Malaysia
[2]Department of Computer Science, International Islamic University Malaysia
firdausyosman@yahoo.com, fwh@utm.my, sherzod@iium.edu.my, nhs@utm.my

In the study of formal language theory, there are three main operations that act on languages, namely concatenation, quotient, and Kleene closure. From there, the deletion operation had been introduced to generalize the operation of quotient. Initially, a symbol or word could only be removed from the left or right extremity of a word by left or right quotient, respectively. Deletion, however, allows for removal of a symbol or word from any place. Many variants of deletion have been introduced over the years with their own properties and generative powers, where restrictions are used to develop new variants and improve their generative powers. Moreover, researchers have also found a connection between deletion and DNA computing. In this paper, by imposing restrictions on the rules of the systems, a new variant of deletion is introduced called computed sequential deletion. Some examples are presented and the relation between this new concept and DNA computing is highlighted.

2010 Mathematics Subject Classification: 68Q45.
Keywords: computed sequential deletion, formal language, DNA computing.

P-47. Encryption and decryption teks.txt using expansion hill cipher method and programming C++

Akik Hidayat*, Rudi Rosadi, Akmal
Department of Computer Science, Universitas Padjadjaran, Indonesia
akik.hidayat@ymail.com, rudirosadi@gmail.com, akmal@unpad.ac.id

Hill Cipher is one of the cryptographic algorithm that utilizes square matrix as a key for encryption and decryption and modulo arithmetic. In this paper, we show that Hill Cipher does not have a square matrix as a key. Each character in the plaintext or ciphertext is converted into numeric form. Encryption is done by multiplying the key matrix with matrix plaintext, while decryption is done by multiplying the inverse matrix with the matrix key ciphertext. Therefore, Hill Cipher can only use a square matrix as a key matrix. Pseudo inverse can be utilized on a Hill Cipher algorithm, so the key matrix used is not limited to a square matrix alone but could use a rectangular matrix key where the order of the number of lines is greater than the number of columns. The use of a rectangular matrix makes the ciphertext is longer than the plaintext. This obviously makes the message becomes more obscured. In this research, we use the data input modulo 95 means there are

95 symbols. To facilitate counting when initialization key matrix, encryption and decryption process, we use C ++ application program.

2010 Mathematics Subject Classification: 68P25, 94A60
Keywords: cryptography, encryption, decryption, Hill cipher expansion, pseudo inverse.

P-48. Fuzzy conditional random fields for temporal data mining

Intan Nurma Yulita, Atje Setiawan Abdullah
Universitas Padjadjaran
intanurma@gmail.com, atje.setiawan@gmail.com

Temporal data mining is one of the interesting problems in computer science and its application has been performed in a wide variety of fields. The difference between the temporal data mining and data mining is the use of variable time. Therefore, the method used must be capable of processing variables of time. Compared with other methods, conditional random field has advantages in the processing variables of time. The method is a directed graph models that has been widely applied for segmenting and labelling sequence data that appears in various domains. In this study, we proposed use of Fuzzy Logic to be applied in Conditional Random Fields to overcome the problems of uncertainty. The experiment compared Fuzzy Conditional Random Fields, Conditional Random Fields, and Hidden Markov Models. The result showed that accuracy of Fuzzy Conditional Random Fields is the best.

2010 Mathematics Subject Classification: 03B52, 62H30, 68T10, 94D05
Keywords: temporal data, data mining, conditional random fields, fuzzy logic.

S10. Control Theory and Optimization

Invited Talks

IT-01. The method of orienting curves for finding optimal paths in restricted areas

Hoang Xuan Phu
Institute of Mathematics, Vietnam Academy of Science and Technology
hxphu@math.ac.vn

The Method of Orienting Curves is presented, which was initially developed for solving optimal control problems with state constraints, but its ideas can also be applied for some optimization problems of finding optimal paths in restricted areas. The helpfulness of this method is illustrated by some application problems:

- a Steiner's problem of finding an inpolgon with minimal circumference,
- a Zermelo's navigation problem,
- optimal control of a hydroelectric power plant,
- an inventory problem,
- time-optimal control of manipulator along a prescribed trajectory,
- finding shortest paths between two points on polytopes in 3D,
- finding the convex envelope of finite points.

2010 Mathematics Subject Classification: 49M05, 65K10, 90B05.
Keywords: optimal control, state constraints, optimal paths.

IT-02. Control problem in bilinear system

Roberd Saragih
Financial and Industrial Math. Research Group, Institut Teknologi Bandung
roberd@math.itb.ac.id

In generally, problems in sciences and engineering have model in nonlinear form. Meanwhile, there is no standard method to obtain the solution for the nonlinear system. To overcome this problem, the solution can be approached by numerical method or by linearization. The other approach is to bilinearization of nonlinear system. In the real problems, naturally, it has model in the bilinear system such as electrical networks, mechanical links, surface vechile, heat transfer, socioeconomics, demography, immunology, and so on. In this talk, we introduce some problems in designing control system for bilinear system. Firstly, we present how to obtain the model reduction for bilinear system. The process of optimization is to minimize the H2-norm from the transfer function from input to output which implies suppressing the magnitude peaks of the frequency response. Furthemore, we design the robust controller with minimum order. Analysis and synthesis of both robust full and reduced order controller are formulated in the linear matrix inequalities. To verify the proposed method, some examples and simulations are carried out.

2010 Mathematics Subject Classification: 49J15, 47N70, 93B52, 62K25, 93B51.
Keywords: bilinear system, robust control, linear matrix inequalities, model reduction, minimum order controller.

IT-03. Robust Optimization Modelling with Applications to Industry and Environmental Problems

Diah Chaerani
Department of Mathematics FMIPA, Universitas Padjadjaran
d.chaerani@unpad.ac.id

Robust Optimization (RO) modelling is one of the existing methodology for handling data uncertainty in optimization problem. The main challenge in this RO methodology is how and when we can reformulate the robust counterpart of uncertain problems as a computationally tractable optimization problem or at least approximate the robust counterpart by a tractable problem. Due to its definition the robust counterpart highly depends on how we choose the uncertainty set. As a consequence we can meet this challenge only if this set is chosen in a suitable way.

The development on RO grows fast, since 2004, a new approach of RO called Adjustable Robust Optimization (ARO) is introduced to handle uncertain problems when the decision variables must be decided as a "wait and see" decision variables. Different than the classic Robust Optimization (RO) that models decision variables as "here and now". In ARO, the uncertain problems can be considered as a multistage decision problem, thus decision variables involved are now become the wait and see decision variables.

In this paper we present the applications of both RO and ARO. For RO modelling, we have some results on Robust Shortest Path Problem, Robust Maximum Flow Problem, Robust Resistance Network Topology Design Problem, Robust Model Predictive Control Design Problem, Robust Forestry Tactical Planning Problem and Robust Vaccination Strategy Problem. For ARO applications, we have some results on Robust Spatial Optimization Problem for Water Supply Allocation and Robust Water Distribution Problem.

We present briefly all results to strengthen the importance of RO and ARO in many real life problems.

2010 Mathematics Subject Classification: 90C05, 90C30.
Keywords: uncertain, robust optimization, adjustable, robust optimization.

IT-04. Fast algorithms for large scale generalized distance weighted discrimination

Xin-Yee Lam[1], Steve Marron[2], Defeng Sun[1], Kim-Chuan Toh[*1]
[1]National University of Singapore, [2]University of North Carolina, Chapel Hill
a0074534@u.nus.edu, marron@email.unc.edu, {matsundf, mattohkc}@u.nus.edu

High dimension low sample size statistical analysis is important in a wide range of applications. In such situations, the highly appealing discrimination method, support vector machine, can be improved to alleviate data piling at the margin. This leads naturally to the development of distance weighted discrimination (DWD), which can be modeled as a second-order cone programming problem and solved by interior-point methods when the scale (in sample size and feature dimension) of the data is moderate. Here, we design a scalable and robust algorithm for solving large scale generalized DWD problems. Numerical experiments on real data sets from the UCI repository demonstrate that our algorithm is highly efficient in solving large scale problems, and sometimes even more efficient than the highly optimized LIBSVM for solving the corresponding SVM problems.

2010 Mathematics Subject Classification: 90C25, 90C06, 90C90.
Keywords: support vector machine, distance weighted discrimination, data piling, scalable algorithm.

Contributed Talks

CT-01. Portfolio optimization based on stock return prediction for investment management strategy

Irma Fitria*[1], Erna Apriliani[2], Endah R. M. Putri[2], Subchan[2]
[1]Kalimantan Institute of Technology, [2]Institut Teknologi Sepuluh Nopember
irma.fitria@itk.ac.id, {april, endah.rmp}@matematika.its.ac.id, subchan@itk.ac.id

In stock investment, there are two things that should be considered by investors. Those are the rate of risk and the rate of return. Generally, investors spread their investment in several companies and make a portfolio to reduce the level of risk. But, in portfolio management, there is a dynamic problem that involves the movement of stock return value over time. Therefore, the information regarding the stock return prediction is very important for investors to anticipate the up and down of stock prices.

In this paper, ARIMA-Onestep method is used to predict the return value of stock prices in the portfolio. Furthemore, based on its prediction, we try to solve the portfolio optimization problem by optimizing every capital in the portfolio using Model Predictive Control (MPC). Thus, the MPC controller is able to provide the best strategy in managing every capital in the portfolio, so that the investors's capital can increased.

2010 Mathematics Subject Classification: 80M50.
Keywords: ARIMA-Onestep, model predictive control (MPC), portfolio optimization, stock return prediction.

CT-02. Analysis of optimal control problem from MERS epidemics models with various intervention

K. Khotimah*, D. Aldila, H. Tasman, H. Padma
Department of Mathematics, FMIPA, Universitas Indonesia, Depok 16424
khusnul.khotimah21@ui.ac.id, {aldiladipo, htasman, herningtyas.padma}@sci.ui.ac.id

This paper investigates the problem of controlling epidemics of Middle East Respiratory Syndrome (MERS) disease through medical mask ($u_1(t)$), governments campaigns about importance of medical mask($u_2(t)$) and supportive care treatment($u_3(t)$). Human population as the state variables are divided into 5 compartments, i.e susceptible without and with medical mask (x_1, x_2), infective without and with medical mask (x_3, x_4) and recovered compartment (x_5) . Our aim is to minimize the total number of infective individuals and the cost associated with the use of the control variables during intervention period. For technical purpose, we define cost function in quadratic form and given by

$$J(X_i, U_i) = \int_0^T \left(\sum_{i=1}^{5} \omega_i \, X_i^2 + \sum_{j=1}^{3} \varphi_i \, u_i^2 \right) dt \qquad (1)$$

with ω_i for $i = 1, 2, 3, 4, 5$ are weight cost for human population, whereas φ_j for $j = 1, 2, 3$ are weight constants for control variables. Due to our aim, therefore $\omega_3 \geq 0, \omega_4 \geq 0, \varphi_i \geq 0$ while the others are zero and to balance the objective functional cost, ω_i and φ_i should satisfy $\frac{\omega_i}{\varphi_j} \approx \frac{U_j^2}{X_i^2}$. Existence and uniqueness results for the optimal control pair are established. The optimality system is derived and then solved numerically using an iterative method based on the gradient descent algorithm. The results from numerical simulation show that the intervention of medical mask, government campaigns and supportive treatment depend on time will be suppressed number of MERS infection significantly.

2010 Mathematics Subject Classification: 92D25, 92D30, 93C95.
Keywords: MERS disease, optimal control, medical mask.

CT-03. Zero suffix method for quadratic transportation problem

Shambhu Sharma
Department of Mathematics, Dayalbagh Educational Institute, Agra, India
ssdei61@gmail.com

A new solution method namely zero suffix method is proposed to solve the quadratic transportation problem. There is no need to trace the graph of each quadratic function. Method is very simple and can be applied by any practitioner who has not much knowledge of mathematics. Method is illustrated with the help of numerical example. In the proposed method each quadratic function are estimated as a constant cost to convert it in classical transportation problem.

2010 Mathematics Subject Classification: 90B06.
Keywords: quadratic transportation problem, estimated cost matrix, transformed cost matrix, reduced cost matrix, zero suffix method, optimal solution.

CT-04. Control theory in optimizing smoking prevalence rate: an overview and potential solution

Tisya Farida Abdul Halim*, Hasimah Sapiri, Norhaslinda Zainal Abidin
School of Quantitative Sciences, Universiti Utara Malaysia, Kedah
tisyahalim@gmail.com, {hasimah, nhaslinda}@uum.edu.my

Smoking prevalence is one of the determinant which play an important role in measuring a successful implementation of tobacco control strategies. Various strategies have been implemented but the smoking prevalence rate is still high. High rate of smoking prevalence leads to smoking-related diseases and health care expenditure. Therefore, it is critical to determine the optimize value of smoking prevalence rate in order to trim down the hazardous effects of smoking to society. Conversely, smoking problem becomes increasingly complex since many issues need to be considered simultaneously. Thus, the purpose of this paper is to review the current techniques used in the previous studies to tackle the issues. Additionally,

this paper presents optimal control theory as the proposed method which is deemed suitable to deal with the issues arise. The control model is expected to obtain the minimum rate of smoking prevalence towards an endgame of tobacco use. The minimum rate of smoking prevalence is expected to obtain by minimizing the Hamiltonian subject to the smoking prevalence rate which is assigned as the state variable while the anti-smoking strategies as the control variable. The outcome is hope to offer insights to tobacco researchers as well as policy makers for making better decisions.

2010 Mathematics Subject Classification: 47N70.
Keywords: control theory, optimizing smoking.

CT-05. Optimal control of diversification model rice and non-rice with target

Retno Wahyu Dewanti[1], Subchan[2]
[1]Institut Teknologi Kalimantan, [2]Institut Teknologi Sepuluh Nopember
retnowahyu@itk.ac.id, s.subchan@gmail.com

Humans need food for survival. Food consumption patterns in Indonesia currently relies heavily on Rice. The fact that Indonesian population keep growing while rice cannot be produced all year long, creates an imbalance between rice consumption and rice production. In order to solve this problem, the government have implemented food diversification policy to reduce the consumption of rice. Diversification of food can be done by producing non-rice food that can be produced locally at low cost. This research present the method of optimal control in the consumption of rice and non-rice focusing on consumption target outcome. Dynamical equation in this research is based on Lotka-Volterra Model. The percentage of consumption level rice and non-rice are the control variable and the objective function is minimize the cost. The objective function solved using Pontryagin Minimum principle. The simulation results showed that the optimal control can handle the diversification rice and non-rice consumption. After the control within one year, the rice consumption decreased optimally to 99.2993 kilogram per capita per year from the initial consumption 100.8 kilogram per capita per year, the difference with final target 0.07, while the non- rice consumption increased to 16.9941 kilogram per capita per year from the initial consumption 16.3 kilogram per capita per year, the difference with target 0.59.

2010 Mathematics Subject Classification: 47N70.
Keywords: rice and non-rice, food diversification with target outcome, optimal control, Pontryagin Minimum Principle (PMP).

CT-06. The fractional calculus of operator valued function with application to control theory

Mardiyana, Riyadi
Faculty of Teacher Training and Education, Sebelas Maret University Surakarta
mardiyana@lycos.com, yadi-laras@yahoo.com

In this paper we study the fractional of vector or operator-valued functions on Banach spaces as a generalization of the fractional calculus of real-valued functions. The properties of the derivative and integral fractional of operator-valued function are derived, especially, the fractional calculus of semi-group operators. We study the basic properties of these objects, also in absence of exponential boundedness. We discuss the generator of the fractional integral of semigroups. Application of this construction will be used to solve the problems on Control Theory.

2010 Mathematics Subject Classification: 47N70.
Keywords: fractional calculus, operator valued functions, semigroup operators, control theory.

CT-07. From heuristic to deterministic: a two step approach to the tomography problem

Renier Mendoza
University of the Philippines Diliman
rmendoza@math.upd.edu.ph

The Electrical Impedance Tomography (EIT) is an inverse problem that reconstructs the image of the conductivity σ of the body Ω using the voltage measurements at the boundary $\partial\Omega$ of the body. The voltage at the boundary is simply the trace at $\partial\Omega$ of the electric potential ϕ of Ω. The quantities σ and ϕ are related via a generalized Laplacian equation subject to a Neumann boundary condition. In this work, we consider the case when $\Omega \subset \mathbb{R}^2$. The majority of the applications of EIT are found in the imaging of the human body. Because the conductivity values of human tissues show great contrast, the quantity σ is typically assumed to be piecewise constant. In other words, Ω is assumed to be subdivided into components, each having different conductivity values. Thus, to recover σ, the geometry of all the components and their corresponding conductivity values must be computed. The recovery of σ can be done by minimizing a functional of least square form.

We approach this problem using the combination of two methods: the Genetic Algorithm (GA) and a gradient-based method. GA is a heuristic algorithm based on Darwin's theory of evolution. GA can effectively calculate the global minimum of a function but it can also be computationally costly. Gradient-based methods are established algorithms that make use of the derivative of the function in finding the local minimum. We combine these methods to estimate the global minimum while saving computational time. We first implement GA to find an initial estimate of σ. Using this initial guess, we employ a gradient-based method to calculate a better approximation of the solution σ.

2010 Mathematics Subject Classification: 65N21, 35J25, 90C59.
Keywords: electrical impedance tomography, genetic algorithm, inverse problem.

CT-08. Newton method for solution of generalized algebraic Riccati equation in linear quadratic dynamic game with feedback

Salmah*, Kirtyana Nindita
Department of Mathematics, Gadjah Mada University
syalmah@yahoo.com, k.nindita@gmail.com

The algebraic Riccati equation that arising from two-player linear quadratic dynamic game with feedback is a couple of algebraic equation that should be solved simultaneously. The first algebraic Riccati equation for the first player include control gain of the second player, and vise versa. Therefore the couple of algebraic Riccati equation is not easy to solve analitically. In this paper, we consider generalized algebraic Riccati equation for the closed loop linear quadratic game in which the objective function of the players include output of the system. The couple of generalized algebraic Riccati equation will be solved numerically with Newton method. With the method, convergence can be achieved. Moreover the convergence is quadratic. In this paper, convergence properties of application of the Newton method to solve the algebraic Riccati equation will be derived. The algorithms of the Newton method can be found by solving Lyapunov equations. The Lyapunov equations will have unique solution if a particular matrix is stable. Numerical example and simulation will be given to illustrate the method. The simulation show that the application of the Newton method will convergent in a few step under moderate conditions.

2010 Mathematics Subject Classification: 49M15, 49N70, 91A10.
Keywords: Newton, algebraic, Riccati, game, feedback.

CT-09. Portfolio optimization under a combined model of stochastic volatility and constant elasticity of variance

Sotheara Veng*, Jai Heui Kim
Pusan National University
sotheara.veng@yahoo.com, jaihkim@pusan.ac.kr

In this paper, we study the Merton portfolio optimization problem under a combined model of the stochastic volatility and constant elasticity of variance (CEV) using asymptotic analysis. The volatility component is driven by an ergodic process characterized by its fast timescale of fluctuation. We derive approximations for the value function and optimal strategy which are corrected forms for those under the CEV model. Explicit expressions for the leading term of the value function are given for the exponential and hyperbolic absolute risk aversion (HARA) utility functions while we derive a simple linear PDE for the first correction term. Moreover, we show that using the leading term of the optimal strategy results in

the value function, not only up to the leading term, but also up to first correction term. We also use the asymptotic analysis to introduce a practical investment strategy that does not depend on the unobservable fast-moving volatility factor. The result is an extension of the Merton's problem in presence of both stochastic volatility and elasticity of variance.

2010 Mathematics Subject Classification: 91G10, 93E20, 93C70.
Keywords: asymptotic analysis, constant elasticity of variance, ergodic process, portfolio optimization, stochastic volatility.

CT-10. Vector optimization and vector variational-like inequalities in terms of convexificators

Yadvendra Singh, S. K. Mishra
Department of Mathematics, Banaras Hindu University, Varanasi-221005, India
{ysinghze, bhu.skmishra}@gmail.com

In this paper, we consider a vector optimization problem and vector variational-like inequalities involving locally Lipschitz invex functions. We formulate vector variational-like inequalities of Stampacchia and Minty type in terms of convexificators and use these vector variational inequalities as a tool to establish necessary and sufficient conditions for a point to be an efficient solution of the vector optimization problem. We also consider the corresponding weak versions of the vector variational-like inequalities and establish various results for the weak efficient solutions. For locally Lipschitz functions convexificators are subsets of many well-known subdifferentials, hence the results of this paper are more general and sharper than corresponding results in the literature.

2010 Mathematics Subject Classification: 90C29, 49J40.
Keywords: vector optimization problems, vector variational-like inequalities, convexificators, generalized covexity.

CT-11. breakpoint: an R package to detect multiple change-points in continuous and count data via the cross-entropy method

W. J. R. M. Priyadarshana*[1], G. Sofronov[2]
[1]Dept. of Statistics, Swinburne University of Technology, Melbourne, Australia
[2]Department of Statistics, Macquarie University, Sydney, Australia
mjayawardana@swin.edu.au, georgy.sofronov@mq.edu.au

The Cross-Entropy (CE) method is an evolutionary stochastic optimization method that was originally developed to estimate probabilities of rare events. Later with the advances of the CE method, it could be used to solve difficult combinatorial optimization problems (COPs) as well. A change-point problem may fall under the broader category of COPs but it may also be considered within control theory. We define the change-point (or break-point) problem as the process of detecting the location where a distributional change has occurred in an observed sequence of

data. Thus, it is a mixture of both estimation and optimization problems. In real life scenarios, there can be more than one change-point in a process. Therefore, a successful procedure should be able to detect both the the number of change-points and their locations simultaneously with a high level of sensitivity. The “breakpoint" R package, which is available on CRAN, can be used to solve these two types of problems. It uses the CE method in the optimization step to obtain the locations of the change-points. An information criterion is used to obtain the number of change-points. The calculations can be carried out both sequentially and in parallel with the use of multiple-cores. In this study, we assess the different functionalities of the package with multiple data sources. At first, a comprehensive simulation study was carried out to detect both the number and the locations of change-points in continuous as well as count data. The results are compared with some of the popular methods that are available in the literature. Finally, we applied the procedures to real data originated from different scientific streams. Our results suggest that the proposed methods in the “breakpoint" package are effective in detecting both the number and locations of change-points in continuous and count data.

2010 Mathematics Subject Classification: 65Y15.
Keywords: breakpoint, cross-entropy method, change-point modelling, model-based stochastic optimization.

CT-12. Shortest path problem on a grid network with unordered intermediate points

Veekeong Saw, Amirah Rahman, Wen Eng Ong*
School of Mathematical Sciences, Universiti Sains Malaysia
dsquid_90@hotmail.com, amirahr@usm.my, weneng@usm.my

We consider a shortest path problem with both single and multiple cost factors on a grid network with unordered intermediate points. A two stage heuristic algorithm is proposed to find feasible solution path within a reasonable amount of time. For performance evaluation of the proposed algorithm, computational experiments are performed on grid maps of varying size and number of intermediate points. Preliminary results for the single cost factor problem are reported. Numerical comparisons against brute forcing show that the proposed algorithm consistently yields solutions that are within 10% of the optimal solution and uses significantly less computation time.

2010 Mathematics Subject Classification: 90B10, 90C29.
Keywords: multiple-criterion shortest path problem, unordered intermediate points, grid network, nearest neighbor algorithm.

CT-13. Optimal solution strategy for University course timetabling problem

Chacha Stephen*[1], Allen Rangia Mushi[2]
[1]Department of Mathematical Sciences, Pusan National University, Korea
[2]Department of Mathematics, Box 35062, University of Dar es salaam, Tanzania
chchstephen@yahoo.com, allen.mushi@gmail.com

This paper describes formulations of the University Course Timetabling Problem (UCTP) as used at Mkwawa University College of Education. University Course Timetabling is the Problem of scheduling resources such as lectures, courses and rooms to a number of timeslots over a planning horizon, normally a week, while satisfying a number of problem-specific constraints. In this study, we have developed three models and tested using real data from the stated University. Comparative analysis on the performances of the models was carried out against existing manual solutions. It has been possible to get optimal solution for real problem instances through reformulations of models which involve a mixture of binary and time-indexed variables. It is concluded that, reformulations of mathematical programming models can improve performance on exact methods.

2010 Mathematics Subject Classification: 90C06, 90C010, 90C011.
Keywords: timetabling Problem, combinatorial optimization, NP-hard problem, reformulations, scheduling.

CT-14. The modification of hybrid method of ant colony optimization, particle swarm optimization and 3-Opt algorithm in traveling salesman problem

Hertono, G.F, Handari, B.D., Ubadah, Silaban, D. R.
Department of Mathematics, Universitas Indonesia
{gatot-f1, bevina, ubadah, denny}@sci.ui.ac.id

The traveling salesman problem (TSP) is a famous problem in finding the shortest tour to visit every vertex exactly once, except the first vertex, given a set of vertices. This paper discusses three modification methods to solve TSP by combining Ant Colony Optimization (ACO), Particle Swarm Optimization (PSO) and 3-Opt Algorithm. The ACO is used to find the solution of TSP, in which the PSO is implemented to find the best value of parameters and that are used in ACO. In order to reduce the total of tour length from the feasible solution obtained by ACO, then the 3-Opt will be used. In the first modification, the 3-Opt is used to reduce the total tour length from the feasible solutions obtained at each iteration, meanwhile, as the second modification, 3-Opt is used to reduce the total tour length from the entire solution obtained at every iteration. In the third modification, 3-Opt is used to reduce the total tour length from different solutions obtained at each iteration. Results are tested using 6 benchmark problems taken from TSPLIB by calculating the relative error to the best known solution as well as the running

time. Among those modifications, only the second and third modification give satisfactory results except the second one needs more execution time compare to the third modifications.

2010 Mathematics Subject Classification: 65K10.
Keywords: traveling salesman problem, ant colony optimization, particle swarm optimization, 3-Opt algorithm.

CT-15. Optimal control of tumor growth with combination of chemotherapy and herbal therapy in myeloma bone disease

Rizki Fauziah*, Mardlijah
Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
10rizkifauziah@gmail.com, mardlijah@matematika.its.ac.id

Tumor is a disease caused by abnormal growth from tissue cells of the body that turn into cancer cells. During its development, the cancer cells can spread to other body parts that can cause death. Nowadays, many ways can be combined for the treatment of tumors.

This research will discuss the optimization of the treatment of tumors, especially regarding myeloma tumor of bone. In this case a bone tumor, the stage of treatment are covered in this research is the bone after bone damage. After the breakdown of bone, the bone itself will make the process of new bone formation through the modeling and remodeling.

The mathematical model of bone remodeling in tumor growth has undergone significant development. This is because research on the healing of tumors and cancer is still being developed by several researchers in the field klinis.In this study, the therapy is conducted in the form of chemotherapy combined with administration of herbal medicine. Issues to be resolved in this research is to find a solution to minimize the growth of myeloma tumors using Pontryagin Minimum Principle.

2010 Mathematics Subject Classification: 49J15.
Keywords: tumor growth, myeloma bone disease, bone remodeling, optimal control, pontryagin minimum principle.

CT-16. Multimodal optimization by using hybrid of artificial bee colony algorithm and BFGS algorithm

Syaiful Anam
Mathematics Department, Brawijaya University, Malang, Indonesia
syaiful@ub.ac.id

Optimization has become one of the important fields in Mathematics. Many problems in engineering and science can be formulated to optimization problems. They maybe have many local optimums. The optimization problem with many local optimums, known as multimodal optimization problems, is how to find the global

solution. Several metaheuristic methods have been proposed to solve multimodal optimization problems such as particle swarm optimization, genetics algorithm, artificial bee colony (ABC) algorithm, etc. The performance of the ABC algorithm is better than or similar to those of other population-based algorithms with the advantage of employing fewer control parameters. The ABC algorithm also has the advantages of strong robustness, fast convergence and high flexibility. However, it has the disadvantages premature convergence in the later search period. The accuracy of the optimal value cannot meet the requirements sometimes. Broyden-Fletcher-Goldfarb-Shanno (BFGS) algorithm is a good iterative method for finding a local optimum. Compared with other local optimization methods, the BFGS algorithm is better. Based on the advantages of the ABC algorithm and the BFGS algorithm, this paper proposes a hybrid of the artificial bee colony algorithm and the BFGS algorithm to solve the multimodal optimization problem.The first step is that the ABC algorithm is run to find a point. In the second step is that the point obtained by the first step is used as an initial point of BFGS algorithm. The results show that the hybrid method can overcome from the basic ABC algorithm problems.

2010 Mathematics Subject Classification: 68T20.
Keywords: multimodal optimization, hybrid, artificial bee colony algorithm, BFGS algorithm.

CT-17. Method of orienting curves for computational geometry

Phan Thanh An
Institute of Mathematics, Hanoi and IST, University of Lisbon
thanhan@math.ac.vn

The method of orienting curves was first introduced by Phu in 1987 for solving some optimal control problems with state constraints. In this talk, based on a geometric idea of the method of orienting curves, we introduce a new method for computing (a) the convex hull of a finite point set, (b) Delaunay triangulation of a finite point set, (c) the shortest path between two points (or two segments) along a sequence of adjacent triangles on a polytope in 3D, that are of most basic problems in computational geometry.

The new method consists of five factors: (e1) determine the boundary for the solution, (e2) determine an initial element of the solution, (e3) construct the final curve and orienting curves through a given point, (e4) construct the restricted area, (e5) the exact solution is constructed from (e3) or (and) (e4). For each problem above, corresponding factors are constructed then the corresponding algorithm determines that the exact solution is constructed by parts of orienting curves and a final curve.

Comparing with 2D Graham's convex hull algorithm, Gift-wrapping convex hull algorithm for the problem (a) and Delaunay triangulation algorithm for the problem (b), the new method reduces the running time. Comparing with Pham Trong,

Szafran, and Biard's algorithm in 2001 and Xin and Wang's algorithm in 2007 for the problem (c), the new method does not rely on unfolding technique and also reduces the running time.

This is a joint work with D. T. Giang (IST, University of Lisbon and Vinh University), H. X. Phu (Institute of Mathematics, Hanoi), K. Polthier (FU Berlin), and L. H. Trang (IST, University of Lisbon and Vinh University).

2010 Mathematics Subject Classification: 49Q10, 68U05
Keywords: Convexity, convex hull, polytope, shortest path.

CT-18. Optimal strategy for supplier selection problem integrated with optimal control problem of single product inventory system with piecewise holding cost

Sutrisno*, Widowati, R. Heru Tjahjana
Department of Mathematics, Diponegoro University, Semarang, Indonesia
{tresno.math, widowati math, heru tjahjana}@undip.ac.id

In this paper, we formulate the hybrid mathematical model of supplier selection problem integrated with inventory control problem of a single product inventory system with piecewise holding cost. This model will be formulated as a piecewise affine (PWA) model that can be converted into mixed logical dynamic (MLD) model. By using this MLD model, we solve the supplier selection problem and control this inventory system so that the stock level tracks the desired level as closed as possible with minimal total cost.

We determine the optimal input i.e. the product's volume and the optimal supplier by using model predictive control for hybrid system. From the computational simulation results, the optimal supplier was selected at each time period and the evolution of the stock level tracks the desired level very well.

2010 Mathematics Subject Classification: 93A30, 93C55, 93C30, 34K34, 34A38.
Keywords: supplier selection, inventory control, hybrid mathematical model.

CT-19. Interior-point algorithms for $P_*(\kappa)$-horizontal linear complementarity problems

Gyeong-Mi Cho[1], You-Young Cho[2]
[1]Dongseo University, [2]Pusan National University
gcho@dongseo.ac.kr, youyoung@pusan.ac.kr

It is well known that kernel functions play an important role in design and analysis of interior-point methods(IPMs) since each kernel function defines an interior-point algorithm. In this paper we propose new IPMs for $P_*(\kappa)$-horizontal linear complementarity problems (HLCPs) based on a new kernel function. New search directions and proximity measures are defined based on this function. Furthermore, we improve the complexity of large-update IPMs for LO of Bai-Ghami-Roos from

$\mathcal{O}\big(n^{\frac{3}{4}}\log\frac{n}{\epsilon}\big)$ to $\mathcal{O}\big((1+2\kappa)\sqrt{n}(\log n)\log\frac{n}{\epsilon}\big)$ and have $\mathcal{O}\big((1+2\kappa)\sqrt{n}\log\frac{n}{\epsilon}\big)$ complexity result for small-update methods, which are currently the best known complexity result for such methods, where κ is the handicap of a pair of $P_*(\kappa)$-matrices. We have tested the algorithm on some examples.

2010 Mathematics Subject Classification: 90C33, 90C51.
Keywords: interior-point method, kernel function, complexity, polynomial algorithm, nonlinear complementarity problem.

Poster Session

P-01. Construction of interval linear programming with interior point methods

Agustina Pradjaningsih*[1], Herry Suprajitno[2], Fatmawati[2]
[1]Department of Mathematics, Jember University, Jember 68121 Indonesia
[2]Department of Mathematics, Airlangga University, Surabaya 60115 Indonesia
tinapradja.math@gmail.com

The coefficients to be known as constants in the conventional linear programming model assumed certainty. However, in the real world, mostly of constants is seldom known certainly. This uncertainty will be estimated using interval. Further developments of this case are that the variables in conventional linear programming are also presented in the form of interval. In this paper, it will be presented the linear programming problems where the coefficients and variables are in the form of intervals. The problems will be solved by transforming into conventional linear programming problems with using interior point methods.

2010 Mathematics Subject Classification: 90C05.
Keywords: linear programming, interval linear programming, interior point methods.

P-02. A case study in timetabling problem using integer linear programming (ILP) model

Nur Aishah Ramli*, Syarifah Zyurina Nordin
Department of Mathematical Sciences, Universiti Teknologi Malaysia
penyu_28@yahoo.com, szyurina@utm.my.

In this paper, we consider a case study on university course timetabling problem. The timetabling problem occurs when the schedule needs to do manually and this will cause the waste of time and resources. Our objective is to obtain a feasible schedule for the timetabling problem that fulfills all the constraints of the lecturers, students, times and locations for each course. An integer linear programming (ILP) model for the timetabling problem is presented. In addition, we implement

and carry out a case study in our department. The result is obtains from the solution of the mathematical formulation using LINGO 14.0.

2010 Mathematics Subject Classification: 90C10, 90B35.
Keywords: timetabling problem, Integer linear programming, university course timetable.

P-03. Combination of an inertial measurement unit and a camera for defining the position of an airplane

Quang Vinh Nguyen
Vietnam Academy of Military Science and Technology
vinhquang2808@yahoo.com

In this article we propose a method of using the extended Kalman filter combined with an inertial measurement unit (IMU) and a camera for determining the location and calculate the parameters of a helicopter. The IMU is used to measure the linear acceleration and the angular velocity of rotation. In case of airplanes one often uses two coordinate systems: the attached coordinate system ($OX_bY_bZ_b$) which is connected with the center of mass of the airplane and the earth reference system ($OX_eY_eZ_e$) which is fixed on the ground. The column of the accelerations of the aircraft in the earth reference system are calculated as the matrix product of the rotation matrix and the column of the accelerations which are measured by the accelometers. By combining the accelerations of the aircraft in the earth reference system we obtain the position of the aircraft. However, this position will diverge over time because of various errors, such as accelerometers, noises ....So the images of the airplane captured by the camera will be processed and the extended Kalman filter will be used to reduce errors. The algorithm is simulated on MATLAB / Simulink and hardened by using dsPIC33F256 chip.

2010 Mathematics Subject Classification: 49N90, 49N99.
Keywords: inertial navigation systems, Kalman filter, helicopter.

P-04. Parallel-post-hybrid genetic algorithm and quasi newton BFGS

Zuraidah Fitriah[1], Liza Tridiana M.[2]
[1]FMIPA Universitas Brawijaya
[2]Mathematics Education Department of Wisnuwardhana University
zuraidahfitriah@ub.ac.id, leeza_be0708@yahoo.com

The conventional optimization method has been developed by the experts, depend on cost functions differentiability, so that the methods were going to reach the convergence condition fast, relatively. The optimal value had been obtained is a local optimal value. Therefore, numerical global optimization methods were developed. This method is only depend on the function value of the objective function without considering continuity and differentiability function. Most modern optimization method based on natural rules such as Genetic Algorithm. Genetic algorithm is developed from the principles of genetics and natural selection. This

method produces a global optimal value for the objective function. However, because of this globality, the genetic algorithm can being prematurely converges, ie. obtained solutions are depending on the number of generation. In order to get more precious search results by Genetic Algorithm, this procedure can be hybridized with local optimization method. Quasi Newton BFGS can be used as a local optimization method that can be used with Genetic Algorithm to get optimal solutions fast. Quasi Newton BFGS was used after the last procedure of genetic algorithm, so that the method is called post-hybrid genetic algorithm. In this paper, we apply some post-hybrid Genetic Algorithm to get several optimal solutions. Then, we choose the best solution of the set of solutions. This whole process is called post-parallel-hybrid Genetic Algorithm. By using several test functions, parallel-post-hybrid genetic algorithm generates optimal solution takes a shorter time compared with genetic algorithm without hybridization.

2010 Mathematics Subject Classification: 11Y16.
Keywords: global optimization, genetic algorithm, post-hybrid genetic algorithm, quasi Newton BFGS.

P-05. Out-of-sample performance of robust mean-variance portfolio

Epha Supandi*[1], Dedi Rosadi[2], Abdurakhman[2]
[1]UIN Sunan Kalijaga, Indonesia, [2]University of Gadjah Mada, Indonesia
epha.supandi@uin-suka.ac.id, {dedirosadi, rachmanstat}@ugm.ac.id

A robust portfolio model has emerged as a powerful tool to resolve the sensitivity issue of the classical portfolio to its inputs (i.e. mean vector and covariance matrix of returns). The robust estimation and robust optimization are two standard methods extensively adopted to construct the aforementioned model. Also in this paper, we propose a modification of robust portfolio where the robust estimation is combined with the robust optimization. The rolling horizon procedure is used to study the out of sample performance of the robust portfolio both in simulated and empirical data sets.

2010 Mathematics Subject Classification: 93D09.
Keywords: robust estimation, robust optimization, mean-variance portfolio, out of sample.

P-06. Second order cone programming norm 1

Caturiyati[1], Ch. Rini Indrati[2], Lina Aryati[2]
[1]Dept. of Mathematics Education, Yogyakarta State University, Indonesia
[2]Dept. of Mathematics, Gadjah Mada University, Yogyakarta, Indonesia
caturiyatiwdd@gmail.com, {rinii, lina}@ugm.ac.id

Second order cone is defined as

$$L^m = \{(x_1, ..., x_m) \in R^m | x_m \geq \sqrt{x_1^2 + ... + x_{m-1}^2}\},$$

$m \geq 2$, and second order cone programming (SOCP) is a matter of Conic: minimize $\{c^T x | Ax - b \geq_K 0\}$, with cone K is the direct product of some second-order cone: $K = L^{m_1} \times L^{m_2} \times ... \times L^{m_k}$ and $\geq_K$ is the conic ordering. i.e. $a \geq_K b \iff a - b \geq_K 0 \iff a - b \in K$. In SOCP problems, a linear function is minimized on the set afine intersection set and direct product of some second order cone. SOCP is convex nonlinear problems with linear programming and quadratic programming as a special case ([2], [6], [9]). In recent years, the problem SOCP got the attention of researchers because broad application range ([1], [2]). Second order cone (SOC) optimization problem could theoretically be solved efficiently using interior point methods. In the development of research in the field of optimization there are shifts in the structure. Kwak [8] proposed a method principal component analysis (PCA) based on optimization techniques that work with the norm L_1. The method is a development of the PCA by the norm L_2. The PCA method is simple and easy to implement. So the perceived development optimization studies lately have a tendency to replace the norm L_2 with the norm L_1([10]).

Meanwhile Kahl and Hartley ([7]) presents a new framework to solve the structural geometry and movement problems, based on the norm L_∞ rather than using a cost function norm L_2. This framework generates efficient computing global estimates, in the sense that its solution is invriant with respect to projective transformation at world coordinate system and similarity transformation in the image plane, because metric distance image of the of projection errors repeated also invariant to the transformation.

In other words it does not require normalization of image coordinates. In addition, various structural problems and movements, such as triangulation, camera redistribution and re-estimation of homografi can be expressed as a quasi-convex optimization problem that can be solved using a SOCP. Becker et.al. ([3]) establish a framework to solve the various issues convex cone with the following approach: first, determine the conic formulation of the problem; second, determining its dual; third, the application refinement; fourth, completed using an optimal method of order one. The usefulness of this approach is its flexibility. An estimator that is called effective in theory and practice is Dantzig selector ([5]), the idea is simply to get consistent estimates of the observed data and minimize the norm l_1.

Dantzig selector is a convex programming problem solution as follows minimize $\|x\|_1$ with constrain $\|A^*(y - Ax)\|_\infty \leq \delta$, where δ scalar and column of matrix A is assumed to be normalized. Based on the described reference and mainly based paper Lobo, et. al. ([9]) that describes a SOCP problem, then in this paper will be discussed SOCP problem by changing the function constraint become functions norm 1 with domain R^n_+.

2010 Mathematics Subject Classification: 90C20, 90C25, 90C30.
Keywords: second order cone, second order cone programming, interior point methods.

P-07. Bi-objective mathematical model for finding the optimal time for sugarcane harvest in Thailand

Surattana Sungnul*, Santipong Prasattong
Wisanlaya Pornprakun, Chanasak Baitiang
King Mongkut's University of Technology North Bangkok, Thailand
{surattana.s, santipong.p}@sci.kmutnb.ac.th, wisanlaya5140662031@hotmail.com
cbt@kmutnb.ac.th

In this work, we study the trading of sugarcane in Thailand. Since the crop year 1992/93, the price of sugarcane depends on its quality (the sweetness) and weight. However, the weight and sweetness of sugarcane are reverse. In general, the sweetness is increasing in time while the weight is decreasing. The main purpose is to find the optimal harvest time of sugarcane in order to maximize the agriculturists' revenue and to minimize the gathering cost. The mathematical model is formulated in bi-objective optimization framework under the office of the Cane and Sugar Board (OCSB) conditions. The ε-constraints method is applied to solve our bi-objective optimization. In conclusion, we analyze and compare the results between harvesting by cutting (fresh sugarcane) and by fire burning (fired sugarcane) in crop year 2013/14.

2010 Mathematics Subject Classification: 90C29, 90C90.
Keywords: bi-objective mathematical model, sugarcane, ε-constraints method.

P-08. Fuzzy mixed integer programming for land use planning in Tumauini, Isabela Philippines

Destiny S. Lutero*, Alleli Ester C. Domingo, Guillermo A. Mendoza
Genaro A. Cuaresma
Mathematics Division, University of the Philippines Los Banos
{dslutero, acdomingo}@up.edu.ph, gamendoz@illinois.edu, gacuaresma@up.edu.ph

Land use planning involves making decisions with multiple stakeholders that have conflicting and competing objectives, integration of assumptions and constraints that are ambiguous and inexact, and evaluation of land suitability. Land use plans for Tumauini, Isabela, Philippines were developed using fuzzy mixed integer goal programming models. All scenarios under the nonpreemptive structure resulted to the same land use plan. The proposed land use plan for nonpreemptive and preemptive structure required minimal land use reassignment. The proposed land use plan under preemptive priority structure achieved better suitability scores and had closer values to the target for every constraint.

2010 Mathematics Subject Classification: 03B52.
Keywords: fuzzy goal programming, mixed integer programming, land use planning

P-09. On the lowest unique bid auction with multiple bids

Parkpoom Phetpradap*, Nawapon Nakharutai
Chiang Mai University, Thailand
parkpoom.phetpradap@cmu.ac.th, nawapon.nakharutai@gmail.com

This study focuses on the lowest unique sealed-bid auctions in which the winning bidder is the one who places the unique bid that has the lowest value where exactly m bids per bidder are allowed. The problem can be seen as injecting a minimum into a random subset of a larger subset. By assuming that bids are identical and independently placed according to a given probability distribution, we obtain various exact probabilities for the auctions, both as a bidder and an observer, for $m = 1, 2$. The results are obtained via the inclusion-exclusion principle. The computational results and algorithms to calculate the probabilities are also given.

2010 Mathematics Subject Classification: 91B26.
Keywords: reverse auctions, sealed unique-bid auctions, static games, inclusion-exclusion principle.

P-10. Properties and approximate construction of the set of trajectories of the control system with integral constraint on the control functions

Huseyin, N.[1], Huseyin, A.[1], Guseinov, K.*[2]
[1]Cumhuriyet University, Turkey, [2]Science Faculty, Anadolu University, Turkey
{nhuseyin, ahuseyin}@cumhuriyet.edu.tr, kguseynov@anadolu.edu.tr

The control system described by a Urysohn type integral equation is considered. It is assumed that the control recourse is limited and it is exhausted by consumption. In general such kind of control efforts are characterized by the integral constraint on the control functions and they arise in the case if the control effort is fuel, energy, finance, food and etc. The set of trajectories of the control system generated by all admissible control functions is studied. It is proved that the set of trajectories is compact in the space of continuous functions and depends on the system's parameters continuously. Approximation of the sections of the set of trajectories is discussed.

2010 Mathematics Subject Classification: 93C23, 45G15.
Keywords: integral equation, control system, integral constraint, approximation.

P-11. Optimal control of performance in institute of court with maximum principle pontryagin method

Cynthia Alvionita Ferima*, Mardlijah
Sepuluh Nopember Institute Of Technology Surabaya
cynthiaalvionita@gmail.com, mardlijah@matematika.its.ac.id

Predator prey system has developed on the performance of the domestic courts in handling corruption cases in Mojokerto district. The main cause of corruption is

because there were related between corruptor and state money. Corruption can be controlled by the imposition of sanctions. The sanctions said that the corruption money must be returned to the state. The purpose of this research is to maximize the sanction that given to corruptor and minimize the number of corruption. Determination of the optimal control using Pontryagin maximum principle and solved numerically. The simulation has been done with the Runge Kutta method of order - 4 and it would be expected to provide up the maximum number of sanctions, minimize corruptor, and maximize money state.

2010 Mathematics Subject Classification: 49N05, 49K35, 93A30.
Keywords: corruption, prey predator model, pontryagin maximum principle, optimal control, Runge-Kutta method of orde - 4.

P-12. Analysis of resampled efficient frontier based on multiobjective portfolio

Abdurakhman
Mathematics UGM, Indonesia
rachmanstat@ugm.ac.id

Appropriate asset allocation in the investment portfolio to maximize profits or minimize the risk. The method is widely used in the optimization of the portfolio is the minimum variance method Markowitz, both one and two constraints. In practice, especially two constraints method is unstable and tend to generate negative weights (short sell). Little change in the input parameter estimation led to major changes in the composition of the portfolio weights. In order to overcome these problems, we developed a portfolio optimization method that can overcome the instability of minimum variance method to reproduce input. One of them is use resampling Optimization (REF, resampled Efficient Frontier) by utilizing the Monte Carlo simulation method. This paper displays performance analysis on portfolio investment research results using REF-Multiobjective that give portfolio weight have no short sell strategies.

2010 Mathematics Subject Classification: 80M50.
Keywords: portfolio optimization, minimum-variance, resampling, Monte Carlo, multiobjective.

P-13. Completion of linear programming problem using a primal-dual exterior point and shortest path

Elis Ratna Wulan*, Irfan Abdul Muhaemin
Mathematics Department, State Islamic University Bandung
elis_ratna_wulan@uinsgd.ac.id, f4n.bontot@gmail.com

Linear programming is a tool used to complete the optimization problem with a linear model of the constraints of available resources. Primal and dual methods are different types of methods that produce two different paths to find the optimal solution. The first path is that possible primal while the second is dual possible that

the original equation. In particular, use a three-stage implementation. The first two stages required to build feasible primal and dual solutions, using primal simplex algorithm. Finally, in the third stage of the algorithm applied primal and dual. Exterior linear programming with the primal dual algorithm is very important to be studied, because in addition to facilitate the calculation of the linear programming problem, Exterior linear programming with the primal dual algorithm is also easier to find the optimal solution. Network analysis is a mix of logical thinking, illustrated with a network of paths and enable processing activities analytically. Network analysis enables an effective planning of a series that has interactivity. Hence was emerge the network for a variety of purposes such as: transportation, electricity, communication, project planning, waterways, road construction, and others. The shortest path problem one form of the problem of network optimization models are used in the field of financial planning, transportations and so forth.

The results of case study that have been done with the completion of the exterior of the primal dual algorithm can be obtained on the calculation of the most cost at least Rp. 1245.321,00 and the results obtained using the shortest path trajectory of the most minimal distance of Jakarta - Manado - Makassar - Jayapura with a total time of 5 hours.

2010 Mathematics Subject Classification: 90C05.
Keywords: linear programming, linear optimization, primal-dual exterior algorithm, network analysis, shortest path.

P-14. Balikpapan's city transport scheduling using max-plus algebra

Winarni[1], Kistosil Fahim[2], Subchan[1]
[1]Departement of Mathematics, Kalimantan Institute of Technology
[2]Departement of Mathematics, Institut Teknologi Sepuluh Nopember
winarni@itk.ac.id, kfahimt@gmail.com, subchan@itk.ac.id

Balikpapan is one of the big cities in Kalimantan Island which has highest mobility characteristics. Therefore, public transportation facilities play important roles in the city society. There are eight routes in Balikpapan's city transportation network that connect regions in this city. However, most people in Balikpapan prefer to use private transportation such as car or motorcycle. As a result, traffic jam problem will be more complicated. People prefer to choose private transportation because public transportation facilities have not satisfied yet. One of the important problems that become a public complaint in this system is about uncertainty of its departure time. This is possible since there is no good scheduling on that system. In this research, the schedule of Balikpapan's city transportation departure is arranged by using max-plus algebra. From this research we obtained Balikpapan's city transportation departure scheduling in every terminal.

2010 Mathematics Subject Classification: 90B35, 15A80.
Keywords: city transport, scheduling, max-plus algebra.

Index of Authors

Abbreviation for Sections

S01. Logic and Foundations / Mathematics Educations / History of Mathematics
S02. Algebra / Lie Theory and Generalizations, Number Theory
S03. Algebraic and Complex Geometry, Geometry
S04. Topology, Analysis and its Applications
S05. Dynamical Systems and Ordinary Differential Equations
S06. Partial Differential Equations
S07. Probability and Statistics
S08. Combinatorics and Graph Theory
S09. Mathematical Aspects of Computer Science, Numerical Analysis and Scientific Computing /Mathematics in Science and Technology
S10. Control Theory and Optimization

Index of Authors

Aban, J. C.,
S02-CT-20, 191
Abdillah, B.,
S09-CT-07, 439
Abdul Halim, N.,
S07-CT-38, 326
Abdullah, A. S.,
S01-P-32, 160
S01-P-55, 176
S07-CT-33, 324
S07-CT-47, 331
S07-P-24, 347
S07-P-41, 356
S07-P-42, 357
S07-P-61, 367
S09-CT-25, 450
S09-P-10, 488
S09-P-13, 490
S09-P-18, 492
S09-P-20, 493
S09-P-48, 510
Abdullah, F. A.,
S05-CT-18, 266
Abdullah, L.,
S07-P-65, 370
Abdurakhman,
S05-P-17, 286
S10-P-05, 527
S10-P-12, 531
Abidin, N. Z.,
S05-CT-40, 277
S10-CT-04, 515
Abiodun G. J.,
S05-CT-33, 274
Abraham, J.,
S09-CT-23, 449
Achuthan, N. R.,
S07-CT-49, 333
Adajar, C. F.,
S02-P-12, 211
Addawe, J. M.,
S05-CT-20, 267
Addawe, J.,
S05-CT-38, 276
S09-CT-43, 460
S09-P-14, 490
Addawe, R. C.,
S07-CT-44, 329
Addawe, R.,
S09-CT-43, 460
Adegboye, O. A.,
S07-CT-05, 308
Ademola, L. A.,
S02-IT-07, 181
Adi, Y. A.,
S05-P-03, 279
Adzima, K. R.,
S09-P-38, 504
Adzima, K.R.,
S09-IT-04, 434
Adzkiya, D.,
S05-P-11, 282
Afendi, F. M.,
S07-CT-25, 319
S07-P-16, 342
S07-P-20, 344
Afifah, Y. N.,
S09-CT-45, 461
Agarwal, A.,
S05-CT-31, 273
Agcaoili, R. V. R.,
S06-P-07, 300
Agustan,
S01-CT-04, 132
S01-P-03, 142
Agustiani, R.,
S02-CT-39, 200
Agustin, I. H.,
S08-CT-39, 400
S08-CT-54, 409
S08-P-29, 428
S08-P-31, 429
Ahmad, S.,
S08-CT-47, 405
S08-P-04, 414
Ahmad, T.,
S08-P-35, 431
Akbar, M. D.,
S09-CT-74, 479
Akbar, M.,
S02-P-10, 210
Akcan, U.,
S08-CT-55, 409
Akhadkulov, H.,
S05-IT-04, 254
Akmal,
S09-P-13, 490
S09-P-20, 493
S09-P-47, 509
Aksioma, D. F.,
S07-P-73, 374
Akyar, E.,
S08-CT-55, 409
Akyar, H.,
S08-CT-55, 409
S09-CT-35, 456
Albirri, E. R.,
S08-P-17, 421
Aldila, D.,
S05-CT-12, 262
S05-CT-14, 263
S05-CT-39, 277
S07-CT-50, 333
S07-P-19, 344
S09-P-38, 504
S10-CT-02, 514
Ali, N. M. M.,

S02-CT-14, 189
Ali, R. M.,
S04-IT-05, 230
Almaisurie, Q.,
S01-P-20, 153
S01-P-56, 176
Almocera, A. E. S.,
S05-CT-26, 270
Almocera, L. S.,
S05-CT-21, 267
Alsharari, F.,
S05-IT-04, 254
Alshimbayeva, D.,
S09-CT-09, 440
Amam, A.,
S01-P-42, 167
Ambar, F.,
S08-P-04, 414
Ambrosio, J. R.,
S01-CT-07, 134
Amin, S. M.,
S01-CT-14, 139
Amir, A. K.,
S02-P-09, 209
Amirali, I.,
S05-CT-01, 256
Amiraliyev, G. M.,
S05-CT-01, 256
Amor, D.,
S07-CT-33, 324
Amri, I. F.,
S07-P-56, 364
Amrullah,
S08-P-06, 415
An, P. T.,
S10-CT-17, 523
Anam, S.,
S05-P-12, 283
S10-CT-16, 522
Andari, S.,
S07-P-72, 373
Andriyana, Y.,
S07-P-66, 370
S07-P-67, 371
Andriyati, A.,
S05-CT-34, 274
S07-P-25, 348
Ang, K. C.,
S09-CT-70, 476
Ang, M. H.,
S02-CT-21, 192
Anggistia, M.,
S07-P-32, 352
Anggraini, V.,
S01-P-40, 166
Anggriani, N.,
S09-CT-13, 443
Aniversario, I. S.,
S08-P-16, 421
Annas, S.,
S07-P-60, 366
Antoro, S. C.,
S08-CT-59, 412
Anwar,
S01-CT-01, 131
Applanaidu, S. D.,
S05-CT-40, 277
Apriliani, E.,
S05-P-11, 282
S07-CT-11, 311
S10-CT-01, 514
Apriliani, T.,
S08-CT-45, 403
Apriliani, V.,
S05-CT-35, 275
Aprilla H, V.,
S07-P-16, 342
Arances, E. A. C.,
S02-CT-34, 198
Arceo, C. P. P.,
S09-CT-02, 436
Ardaneswari, G.,
S09-CT-50, 464
S09-CT-63, 472
Aribowo, W.,
S08-P-15, 420
Ariestha, W. B.,
S08-P-12, 419
Arif, D. K.,
S05-P-11, 282
Ariffin, A. K.,
S09-CT-61, 471
Ariola, S. A.,
S08-CT-24, 392
Aris, N.,
S05-CT-07, 259
S05-CT-27, 270
Armada, C. L.,
S08-CT-23, 391
Arman,
S03-CT-08, 221
Arora, R.,
S05-CT-25, 269
S06-CT-08, 292
S06-CT-09, 293
S06-P-05, 298
Arriola, B. H.,
S08-CT-14, 386
Aryati, L.,
S04-CT-11, 237
S05-P-03, 279
S05-P-05, 280
S05-P-10, 282
S10-P-06, 527
As'ari, A. R.,
S01-CT-01, 131
S01-CT-03, 132
S01-P-16, 151
Ascaño, J. P.,
S02-P-06, 208
Asih, T. S. N.,
S05-P-10, 282
Asmiati,
S08-P-01, 412
Asri, D. C.,
S01-P-41, 167
Assiyatun, H.,
S08-CT-26, 393
S08-CT-29, 394
S08-CT-31, 395
S08-CT-33, 397
S08-IT-03, 376
S08-P-03, 413
Astuti, A. B.,
S07-P-57, 365
Astuti, D.,
S07-P-17, 343
Astuti, P.,
S02-CT-31, 197
Astutik, E. P.,
S01-P-39, 165
Aunzo, R. T.,
S01-CT-15, 140
Awang, N.,
S09-P-34, 502
Ayob, A.,
S07-P-65, 370

Azizah, F.,
S02-CT-41, 201
Azizah, Y. N.,
S08-CT-39, 400

Bača, M.,
S08-CT-31, 395
S08-CT-44, 403
Babierra, A. L.,
S09-CT-10, 441
Bacani, J. B.,
S04-CT-19, 241
S04-CT-23, 243
Bacara, L. B.,
S04-CT-06, 235
Baccay, E. B.,
S07-CT-45, 330
Bahri, M.,
S04-CT-03, 233
Baitiang, C.,
S10-P-07, 529
Bakar, M. T.,
S01-P-17, 151
S01-P-18, 152
Bakri, R.,
S07-P-20, 344
Balmaceda, J. M. P.,
S02-CT-06, 184
S03-CT-06, 220
S08-CT-12, 385
Banerjee, M.,
S09-P-01, 481
S09-P-09, 487
Bao, W.,
S06-IT-03, 288
Barak, A.,
S07-P-49, 360
Baringhaus, L.,
S07-IT-01, 301
Barra, A.,
S02-CT-36, 199
S09-CT-73, 478
Basilla, J. M.,
S02-CT-20, 191
S02-CT-34, 198
S02-P-08, 209
Basir, C.,
S07-P-15, 342
Baskoro, E. T.,
S08-CT-07, 382
S08-CT-09, 383
S08-CT-10, 384
S08-CT-17, 388
S08-CT-26, 393
S08-CT-29, 394
S08-CT-31, 395
S08-CT-32, 396
S08-CT-33, 397
S08-CT-43, 402
S08-CT-44, 403
S08-CT-50, 406
S08-P-03, 413
S08-P-06, 415
S09-P-21, 494
S09-P-27, 498
Batkunde, H.,
S04-CT-12, 238
Baur, K.,
S02-IT-05, 180
Bautista, R. L. R.,
S01-CT-07, 134
Becerra, T. P.,
S04-CT-20, 241
Benitez, J. V.,
S04-P-04, 246
Beren, C.,
S07-CT-15, 314
Bhagat, A.,
S09-CT-12, 442
Bhatia, S. K.,
S05-CT-31, 273
S05-CT-36, 275
Bhatta, C. R.,
S09-P-44, 508
Bhattacharyya, A.,
S03-P-01, 224
Bin Mohd, I., S07-P-47,
359
Blas, N. T.,
S05-CT-20, 267
Bock, W.,
S07-P-54, 363
Bodromurti, W.,
S07-P-06, 337
Bokhary, S. A. U. H.,
08-CT-46, 404
Bolhassan, N. A.,
S09-P-06, 485
Bong, C. L.,
S09-P-06, 485
Boucherie, R.J.,
S07-CT-14, 313
Boudaoud, F.,
S02-P-15, 212
Brenner, S. C.,
S09-IT-05, 435
Briones, A. E. K.,
S07-CT-44, 329
Bu, S.,
S09-P-29, 499
Budayasa, I K.,
S01-P-05, 143
S01-P-06, 144
S01-P-14, 149
S01-P-51, 173
S08-P-10, 418
Budhi, W. S.,
S04-CT-27, 245
Budiantara,
S07-CT-41, 328
Budiantara, I N.,
S07-P-38, 355
S07-P-52, 362
Bulatov, M. V.,
S05-CT-28, 271
Buloron, J. N.,
S02-CT-06, 184
S08-CT-12, 385
Bunag, E. S.,
S01-P-04, 143
Bussaban, L.,
S02-P-01, 206
Bustamam, A.,
S09-CT-07, 439
S09-CT-50, 464
S09-CT-63, 472
S09-IT-04, 434
S09-P-03, 483
S09-P-04, 483
S09-P-05, 484
S09-P-38, 504
S09-P-39, 504
Bustomi,
S02-CT-36, 199
Byeon, J.,
S06-IT-04, 288

Cabarrubias, B.,
S04-CT-10, 237
Cabillan, M. L. C.,
S01-CT-07, 134
S08-CT-06, 382
S08-CT-48, 405
Caga-Anan, R. L.,
S06-CT-10, 293
Cahyono, E.,
S09-CT-59, 470
Cahyono, S. D.,
S09-CT-29, 453
Candrawati, L.,
S05-P-07, 280
Canoy Jr., S. R.,
S08-CT-15, 386
S08-CT-23, 391
S08-CT-24, 392
Carissa, S. M. P.,
S07-CT-22, 317
Carnia, E.,
S02-P-02, 206
S02-P-03, 207
Caturiyati,
S10-P-06, 527
Cauntongan, O. I.,
S08-P-26, 426
Celeste, R. O.,
S08-CT-16, 387
Celeste, R.,
S02-P-12, 211
Chadidjah, A.,
S07-P-41, 356
Chaerani, D.,
S07-P-24, 347
S07-P-42, 357
S10-IT-03, 512
Chakraborty, D.,
S04-P-12, 250
Chang, J. J.,
S09-CT-32, 455
Changat, M., S08-IT-06,
378
Changphas, T.,
S02-CT-33, 198
S02-P-01, 206
S02-P-04, 207
Chaturvedi, P.,
S09-CT-41, 459
Chauhan, S.,
S05-CT-31, 273
S05-CT-36, 275
Chen, D.,
S07-IT-08, 305
Chen, L.,
S08-CT-57, 410
Chen, X.,
S07-IT-03, 302
Chendra, E.,
S07-P-13, 340
Cheng, H. M.,
S09-CT-01, 436
Chernov, A.,
S09-CT-33, 455
Chia, G. L.,
S08-IT-08, 379
Chiba, H.,
S05-IT-01, 252
Chiew, K. L.,
S09-P-06, 485
S09-P-08, 486
Chishti, T. A.,
S04-P-03, 246
Cho, D. H.,
S07-CT-08, 309
Cho, E. K.,
S02-CT-15, 189
Cho, G. M.,
S10-CT-19, 524
Cho, G.,
S05-CT-13, 263
Cho, H. R.,
S04-CT-22, 243
S04-CT-24, 244
Cho, Y. Y.,
S10-CT-19, 524
Choi, Q H.,
S06-CT-12, 294
S06-CT-13, 295
Choi, S. I.,
S08-P-07, 416
Choir, A. S.,
S07-CT-23, 318
Choji, N. M.,
S07-P-01, 334
Cholamjiak, P.,
S09-CT-24, 450
Cibils, C.,
S02-IT-02, 179
Collera, J. A.,
S05-CT-03, 257
S09-CT-10, 441
S09-CT-30, 453
Collinson, R.,
S07-CT-49, 333
Consorte, O.,
S02-CT-42, 202
Corcino, R. B.,
S08-CT-16, 387
Cortez, M. J. V.,
S09-CT-10, 441
Cruzeiro, A. B.,
S07-IT-03, 302
Cuaresma, G. A.,
S10-P-08, 529
Cyrilla, L.,
S07-P-30, 351

Dörfler, M.,
S04-P-14, 251
da Silva, J. L.,
S07-P-54, 363
Dafik,
S08-CT-39, 400
S08-CT-53, 408
S08-CT-54, 409
S08-P-29, 428
S08-P-30, 429
S08-P-31, 429
Dagal, K. A. P.,
S02-CT-32, 197
Dagondon, S.,
S02-CT-24, 193
Dai, Z.,
S03-P-03, 225
Dang, N. H.,
S05-IT-03, 253
Dara, S.,
S08-CT-03, 380
S08-CT-40, 400
Darhim,
S01-CT-08, 135
Daria, N. A. A.,
S08-CT-48, 405
Darmaji,
S08-P-32, 430
S08-P-34, 431

Darmawan, R. N.,
S08-P-29, 428
Darnius, O.,
S07-P-63, 368
Darti, I.,
S05-CT-09, 261
S05-CT-17, 265
S05-P-12, 283
Darus, M.,
S04-IT-06, 230
Darusman, L. K.,
S07-P-20, 344
Dat, L. Q.,
S09-CT-72, 478
Datong, G. M.,
S07-P-01, 334
David, G.,
S05-CT-20, 267
S09-CT-60, 470
David, R. J.,
S09-CT-01, 436
de Lara-Tuprio, E. P.,
S07-P-39, 355
de Lara-Tuprio, E.,
S04-CT-07, 235
De Las Peñas, M. L. A.,
S03-P-04, 225
De Las Peñas, M. L. A. N.,
S02-CT-11, 187
S03-P-05, 226
de los Reyes, A. A. V,
S05-P-09, 281
Debataraja, N. N.,
S07-CT-42, 328
S07-P-31, 351
Desfitri, R.,
S01-CT-09, 136
Deswita, L.,
S09-CT-40, 459
Dewanti, R. W.,
S10-CT-05, 516
Dewanto, S. P.,
S01-P-55, 176
S07-P-24, 347
Dewanto, S.,
S07-CT-33, 324
Dey, S.,
S03-P-01, 224
Dhar, J.,
S05-CT-36, 275
Dharmawan, K.,
S07-CT-19, 315
Diaz, J. L. B.,
S07-CT-45, 330
Diener, M.,
S07-P-58, 365
Dieu, N. T.,
S05-IT-03, 253
Dimabayao, J. T.,
S02-CT-17, 190
Dinh, H. H.,
S02-CT-45, 204
Dinh, T. C.,
S04-IT-01, 228
Djojosugito, R. A.,
SL-03, 127
Do, V. T.,
S02-CT-16, 190
Doan, T. L.,
S01-CT-10, 136
Doan, T. S.,
S05-IT-02, 252
Docdoc, S. M. S.,
S04-P-04, 246
Dokhi, M.,
S07-CT-23, 318
Domilies, S. G. S.,
S08-CT-06, 382
Domingo, A. E. C.,
S10-P-08, 529
Donato, P.,
S04-CT-10, 237
Dong, F.,
S08-IT-02, 376
Doraisamy, M. V.,
S09-P-02, 482
Du, N. H.,
S05-IT-03, 253
Duan, H.,
S04-IT-08, 232
Duzhin, F.,
S01-CT-02, 131
Dzulfikar, A.,
S08-P-25, 426

Ebner, B.,
S07-IT-01, 301
Edhelyn, R.,
S08-P-35, 431
Edriati, S.,
S01-P-34, 162
S01-P-36, 163
Edwar, I. P.,
S09-CT-40, 459
Effendie, A. R.,
S07-CT-04, 307
Ekawati, R.,
S01-CT-12, 137
Elastic, P.,
S09-CT-59, 470
Elfiyanti, G.,
S02-CT-28, 195
Elipane, L. E.,
S01-IT-03, 129
Endrayanto, A.I.,
S07-CT-14, 313
Endrayanto, I.,
S09-CT-06, 439
Eniego, A. A.,
S08-CT-36, 398
Erawaty, N.,
S02-P-09, 209
Erfanian, A.,
S02-CT-14, 189
Erlangga, Y.,
S09-CT-09, 440
Erliana, W.,
S07-P-28, 350
Escaner, J. M. L. IV,
S05-P-09, 281
Eshkuvatov, Z. K.,
S07-P-10, 339
S09-CT-37, 457
Eugenio, M. A. M.,
S07-CT-44, 329

Fa'rifah, R. Y.,
S09-P-42, 506
Fadhlurrahman, A.,
S05-CT-22, 268
Fahim, K.,
S10-P-14, 532
Faisal,
S08-P-36, 432
Faizah, H.,
S01-P-47, 170

Fakhmi, L.,
S01-P-19, 152
Falah, A. N.,
S07-CT-16, 314
Fathurahman, M.,
S07-CT-15, 313
Fatimah, F.,
S07-P-07, 337
Fatmawati,
S10-P-01, 525
Fauziah, R.,
S10-CT-15, 522
Fazlika, J.,
S05-CT-07, 259
Febriana, R.,
S01-P-38, 164
Febrilia, B. R. A.,
S07-P-59, 366
Felipe, B. C. L.,
S08-CT-06, 382
Ferawati, E.,
S08-P-19, 423
Ferdinand, F. V.,
S01-P-22, 154
Ferianto, S. R.,
S09-P-40, 505
Ferima, C. A.,
S10-P-11, 530
Fernandes, A. A. R.,
S07-P-03, 335
Ferrer Jr, V. I.,
S08-CT-48, 405
Fiangga, S.,
S01-CT-12, 137
Firdaus, R. A. J.,
S09-CT-57, 468
Fithriasari, K.,
S07-CT-32, 323
S07-P-46, 359
Fitri, D. Y.,
S01-P-40, 166
Fitri, S.,
S05-CT-09, 261
Fitria, I.,
S10-CT-01, 514
Fitriah, Z.,
S10-P-04, 526
Fitriani,
S02-CT-27, 195
Fitrianti, Y.,
S01-P-17, 151
S01-P-18, 152
Fitt, A.,
S09-P-19, 493
Flint, I.,
S07-IT-06, 304
Folmer, H.,
S07-CT-01, 305
S07-CT-26, 320
Fontana, M.,
S02-CT-35, 199
France-Jackson, H.,
S02-CT-05, 184
Frettlöh, D.,
S03-P-05, 226
Fu, V. T. Y.,
S09-IT-01, 433
Fujino, O.,
S03-IT-02, 214

Galindo, S. M. A.,
S02-CT-46, 205
Ganai, H. A.,
S08-CT-13, 385
Gao, Z.,
S09-CT-21, 448
Garces, I. J. L.,
S08-CT-36, 398
S08-CT-42, 402
Garciano, A. D.,
S08-P-09, 417
Garciano, A.,
S02-CT-22, 192
Garminia, H.,
S02-P-14, 211
Garnadi, A. D.,
07-P-28, 350
S06-CT-07, 292
Gaviño, N. A. L.,
S08-CT-06, 382
Gervacio, S. V.,
S08-CT-01, 379
Ghorpade, S. R.,
PL-02 , 121
Gilani, A.,
S02-CT-25, 194
Gita, A.,
S01-P-30, 159
Go, C. E.,
S08-CT-15, 386
Gomi, Y.,
S02-CT-11, 187
Goncalvès, E.,
S09-CT-16, 445
Gonzales, K. J. M.,
S08-CT-16, 387
Granario, D. Q.,
S02-CT-07, 185
Gudla, B.,
S08-CT-58, 411
Gueco, E. N.,
S02-P-06, 208
Gunardi,
S07-CT-14, 313
S07-CT-39, 327
S07-CT-41, 328
Gunarso, B.,
S07-CT-18, 315
Gunawan, A. Y.,
S05-CT-04, 257
S05-P-08, 281
Gunawan, H.,
PL-06, 124
S04-CT-05, 234
S04-CT-27, 245
Gupta, R.,
S07-CT-49, 333
Guseinov, K.,
S10-P-10, 530

Ha, J.,
S04-CT-24, 244
Habibi, Y.,
S09-P-11, 488
Hadi, S.,
S09-P-15, 491
S09-P-24, 496
S09-P-25, 497
S09-P-26, 498
Hadiati,
S08-P-20, 423
Hairer, M.,
PL-03, 122
Hakim, A. R.,
S07-CT-07, 309
S07-P-18, 343
Hakim, I. M.,

S07-CT-07, 309
S07-P-18, 343
Hakim, RB. F.,
S07-P-07, 337
Halfiani, V.,
S06-CT-06, 291
Halim, T. F. A.,
S10-CT-04, 515
Halimah,
S08-CT-30, 395
Hamonangan, Y. Y.,
S02-CT-18, 191
Hamson, K. M.,
S09-CT-37, 457
Hamzah, D. A.,
S06-CT-11, 294
Handari, B. D.,
S05-CT-16, 265
S07-P-19, 344
S09-CT-68, 475
Handari, B.D.,
S10-CT-14, 521
Handayani, A. D.,
S01-P-43, 168
S09-P-40, 505
Hang, N. T. T.,
S03-CT-14, 223
Harahap, A. S.,
S07-CT-40, 327
Hardianti, M. S.,
S05-P-03, 279
S05-P-05, 280
S05-P-10, 282
Harisman, Y.,
S01-P-42, 167
Hariyanto, F.,
S09-CT-52, 465
Harlianto, D.,
S07-P-09, 338
Hartanti, P.,
S01-P-02, 142
Hartanto, A. D.,
S02-P-05, 207
Haryadi,
S04-CT-21, 242
Haryani, F.,
S09-CT-55, 467
Haryatmi,
S07-CT-41, 328
Haryeni, D. O.,
S08-CT-44, 403
Haryono,
S07-P-73, 374
Haryono, Y.,
S01-P-38, 164
Hasan, M. S.,
S08-P-29, 428
Hasan, M.,
S08-CT-39, 400
Hasan, Y. A.,
S05-CT-18, 266
Hasbullah, E. S.,
S07-CT-38, 326
Hasibuan, R.,
S09-CT-61, 471
Hasmawati,
S08-CT-08, 383
Hasni, R.,
S08-CT-27, 393
Hassim, H. I. M.,
S02-CT-04, 183
S02-CT-26, 194
S02-IT-06, 181
Hayat, S.,
S08-CT-02, 380
Hazhiah, I. T.,
S07-P-53, 362
Hegde, S. M.,
S08-CT-03, 380
S08-CT-40, 400
Hendy,
S08-P-25, 426
Heng, F. W.,
S09-P-46, 509
Henze, N.,
S07-IT-01, 301
Herlina,
S01-P-09, 146
Hermawan, E.,
S07-CT-47, 331
S07-P-24, 347
S07-P-61, 367
Hermawan, N.,
S07-CT-03, 307
Hertono, G.F,
S10-CT-14, 521
Heryanto, R.,
S07-P-20, 344
Hidayat, A.,
S09-P-13, 490
S09-P-47, 509
Hidayat, D. W.,
S08-P-05, 415
Hidayat, R.,
S08-P-29, 428
Hidayat, Y.,
S07-P-47, 359
Hidayati, S.,
S07-P-44, 358
Hijriati, N.,
S02-CT-23, 193
S02-CT-29, 196
Hoang, T. T.,
S05-IT-02, 252
Hossain, MD. K.,
S07-CT-02, 306
Hoyyi, A.,
S01-P-35, 162
Hsu, S. B.,
S05-CT-26, 270
Hu, H.,
S03-IT-03, 215
Huang, S. Y.,
S05-CT-02, 256
S05-CT-06, 259
Huda, C.,
S01-P-31, 160
Hui, S.,
S04-P-12, 250
Hui-Mean, F.,
S07-CT-48, 332
Huseyin, A.,
S10-P-10, 530
Huseyin, N.,
S10-P-10, 530
Husin, U. T.,
S09-CT-48, 463
Husniah, H.,
S07-CT-12, 312
S09-P-45, 508
Hussanan, A.,
S06-CT-14, 296
Huynh, T. T.,
S06-CT-03, 290

Idris, M.,
S04-CT-05, 234

Idrus, N. M.,
S02-IT-06, 181
Ik, K. K.,
S09-CT-08, 440
Ilias, M. R.,
S09-CT-47, 462
S09-CT-56, 468
S09-CT-69, 476
Ilyas, M.,
S01-P-52, 173
Im, B. H.,
S02-CT-02, 182
Imran, M.,
S02-P-09, 209
S08-CT-46, 404
S09-CT-40, 459
Imron, C.,
S09-CT-03, 437
S09-CT-36, 457
S09-CT-45, 461
S09-CT-49, 463
Indangan, R.,
S02-CT-30, 196
Indra, T. L.,
S07-P-33, 352
Indrati, Ch. R.,
S04-CT-11, 237
S08-CT-57, 410
S10-P-06, 527
Indratno, S. W.,
S07-P-26, 348
S07-P-37, 354
Indriati, D.,
S08-P-27, 427
Iqbal, Q.,
S08-CT-02, 380
Irawan, E. B.,
S01-CT-01, 131
Irawan, M. I.,
S09-CT-67, 474
Irawan, W. H.,
S05-P-15, 285
Irianingsih, I.,
S07-P-41, 356
Iriawan, N.,
S07-CT-23, 318
S07-CT-32, 323
S07-P-57, 365
Irsan, M. Y. T.,
S09-CT-66, 474
Irwansyah,
S09-CT-73, 478
Isa, Z. M.,
S09-CT-47, 462
Iskandar, A. A.,
S09-P-03, 483
Ismail, Z.,
S09-CT-15, 444
S09-CT-54, 466
S09-P-19, 493
Isnaini, U.,
S02-CT-44, 203
Iswadi, H., S08-P-33, 430

Jaharuddin,
S05-CT-35, 275
Jambu, M.,
S03-IT-05, 216
Jamil, F. P.,
S08-P-16, 421
Jampachon, P.,
S02-CT-13, 188
Jang, B.,
S09-CT-17, 445
Jangid, K.,
S09-CT-22, 448
Jatnika, A. W.,
S09-P-27, 498
Javellana, L.,
S09-P-14, 490
Jaya, A. K.,
S07-CT-17, 314
S07-P-22, 346
Jaya, I G. N. M.,
S07-CT-26, 320
S07-CT-47, 331
S07-P-24, 347
S07-P-61, 367
S09-P-10, 488
S09-P-18, 492
Jian, Z.,
S09-IT-06, 435
Jiang, P.,
S03-P-06, 227
Jiann, L. Y.,
S09-P-19, 493
Jin, X.,
S08-IT-07, 378
Jnawali, J.,
S09-P-44, 508
Jo, J. H.,
S04-CT-17, 240
Joebaedi, K.,
S07-P-41, 356
Jose, E. C.,
S09-CT-02, 436
S09-CT-10, 441
Julaeha, S.,
S08-P-20, 423
Juliana, S.,
S01-P-26, 157
S01-P-28, 158
S01-P-49, 172
Juliaristi, F.,
S07-P-46, 359
Jun, D.,
S07-CT-35, 325
Jung, Il H.,
S05-CT-13, 263
S05-CT-15, 264
Jung, S. D.,
S03-CT-12, 223
Jung, T.,
S06-CT-12, 294
S06-CT-13, 295
Juniati, D.,
S01-CT-04, 132
S01-P-03, 142
S01-P-05, 143
S01-P-07, 145
S01-P-08, 145
S01-P-12, 148
S01-P-14, 149
S01-P-51, 173
S05-CT-11, 262
S05-P-14, 284
S08-P-10, 418
Juvito, D. A.,
S08-CT-19, 389

Kadir,
S01-CT-05, 133
S01-P-53, 174
Kalayathankal, S. J.,
S09-CT-23, 449
Kalinowski, T.,
S08-CT-37, 399

Kalla, Y. H.,
S07-P-71, 373
Kamada, N.,
S04-CT-15, 239
Kamada, S.,
S04-IT-04, 229
Kamil, A. A.,
S07-CT-02, 306
Kammuji, M.,
S07-P-10, 339
Kanaya, S.,
S07-P-20, 344
Kappuw, S.,
S09-P-12, 489
Karjanto, N.,
S01-CT-13, 138
S01-P-01, 141
Kartika, D. R.,
S08-P-18, 422
Kartiko,
S07-P-29, 350
Kartiko, S. H.,
S07-P-29, 350
Kasbawati,
S05-CT-04, 257
Kawabe, J.,
S04-CT-14, 239
Kekaleniate, H.,
S08-CT-43, 402
Kempa, V.,
S08-P-32, 430
Kencana, E. N.,
S07-CT-20, 316
S07-P-43, 357
Khabibah, S.,
S01-CT-14, 139
Khairudin, N. I.,
S05-CT-18, 266
Khairunnisa, S.,
S07-P-68, 371
Khalid, A.,
S09-CT-58, 469
Khan, A.,
S09-CT-46, 462
Khan, I.,
S06-CT-14, 296
S09-CT-14, 443
S09-CT-15, 444
S09-CT-54, 466
S09-CT-58, 469
Khan, N.,
S04-CT-26, 244
Kharis, M.,
S05-IT-07, 255
Kharisudin, I.,
S05-P-17, 286
Kherd, A. S. A.,
S06-CT-05, 291
Khotimah, K.,
S05-CT-39, 277
S10-CT-02, 514
Kim, D.,
S03-CT-11, 222
Kim, G. H.,
S04-CT-01, 232
Kim, G. W.,
S09-P-30, 500
Kim, H. M.,
S05-CT-19, 266
S09-P-28, 499
S09-P-30, 500
S09-P-31, 500
Kim, J. H.,
S10-CT-09, 518
Kim, K. S.,
S05-CT-15, 264
Kim, S.,
S05-CT-13, 263
S05-CT-15, 264
Kim, W. S.,
S06-P-01, 297
Kim, Y. Ho,
S03-CT-09, 221
Kim, Y. J.,
S09-P-28, 499
S09-P-30, 500
Kinasih, I. P.,
S01-P-44, 169
S07-P-59, 366
Kismanti, S. T.,
S09-CT-53, 465
Kisty, C. O.,
S09-CT-26, 451
Kiswanti, N.,
S07-CT-20, 316
Koeshendrajana, S.,
S07-P-05, 336
Kok, W. K.,
S08-P-22, 424
Kola, S. R.,
S08-CT-58, 411
Koolen, J.,
S08-CT-02, 380
Kozhagapar, A.,
S01-P-01, 141
Krismianto,
S07-CT-47, 331
S07-P-61, 367
Kristiana, A. I.,
S08-CT-53, 408
S08-P-30, 429
Kristiani, F.,
S07-CT-29, 322
S07-P-30, 351
Kriswandani,
S01-P-09, 146
S01-P-23, 155
Ku, H.,
S07-CT-35, 325
Kuang, K. S.,
S07-P-04, 336
Kumam, P.,
S03-IT-06, 216
Kumar, P.,
S09-CT-08, 440
Kumari, V.,
S05-CT-36, 275
Kun, DR. S. S.,
S07-P-01, 334
Kuntari, S.,
S08-P-05, 415
Kusmayadi, T. A.,
S08-CT-35, 398
S08-CT-45, 403
S08-P-05, 415
S08-P-18, 422
S08-P-19, 423
Kusnandar, D.,
S07-CT-42, 328
S07-P-31, 351
Kustiawan, C.,
S06-CT-02, 289
Kusuma, D. A.,
S01-P-55, 176
Kusuma, D.,
S01-P-21, 154
Kusuma, W. A.,

S07-CT-25, 319
S07-P-16, 342
Kusumah, Y. S.,
S01-CT-08, 135
S01-IT-04, 130
Kusumawati, R.,
S07-P-70, 372
Kusumo, F. A.,
S05-IT-07, 255
S05-P-03, 279
S05-P-05, 280
S05-P-10, 282
S07-CT-14, 313
Kuswanto, H.,
S07-CT-21, 317
S07-P-44, 358
Kwon, J. H.,
S02-IT-04, 180

Labendia, M. A.,
S04-CT-07, 235
Lagura, M. C. T.,
S08-P-09, 417
Lam, X. Y.,
S10-IT-04, 513
Lan, N. P. H.,
S02-CT-47, 205
Lao, A. P.,
S09-CT-02, 436
Lapaan, R. D. O.,
S07-CT-44, 329
Lapid, E.,
S02-IT-01, 179
Lee, H. G.,
S09-IT-02, 433
Lee, H. W.,
S04-CT-22, 243
S04-CT-24, 244
Lee, J. B.,
S04-CT-17, 240
Lee, J. Y.,
S09-IT-02, 433
Lee, J.,
S05-CT-24, 269
Lee, P. Y.,
S04-CT-02, 232
Lee, S. K.,
S04-CT-08, 236
Lee, Y. H.,
S05-CT-24, 269
Lee, Y. J.,
S09-CT-44, 461
Lee, Y. W.,
S04-CT-01, 232
Lee, Y.,
S02-CT-15, 189
S03-IT-04, 215
Lemence, R. S.,
S03-CT-02, 217
Lemence, R.,
S04-P-12, 250
Lesmono, D.,
S07-CT-13, 312
S07-P-13, 340
Lesnussa, Y. A.,
S09-P-12, 489
Lestari, D.,
S05-P-07, 280
S09-P-05, 484
Lestari, F. C.,
S07-CT-28, 321
S07-CT-30, 322
S07-P-21, 345
S07-P-23, 346
Leyson, D. T.,
S03-CT-02, 217
Lilibeth, V.,
S02-CT-42, 202
Limansyah, T.,
S07-CT-13, 312
Linawati, L.,
S09-P-17, 492
Lissa, H.,
S06-P-03, 297
Liu, H. K.,
S09-CT-32, 455
Liu, X. Y.,
S03-P-06, 227
Liu, Z.,
S03-P-06, 227
Lope, J. E. C.,
S05-IT-06, 255
S06-CT-10, 293
Loquias, C. M.,
S08-CT-12, 385
Loquias, M. J. C.,
S02-CT-43, 203
Loyola, M. L.,
S02-CT-11, 187
Luangchaisri, P.,
S02-CT-33, 198
Lucilo, J.,
S09-CT-05, 438
Lucyana,
S01-CT-05, 133
Lukas, S.,
S01-P-22, 154
Lukito, A.,
S01-CT-14, 139
S01-P-06, 144
S01-P-46, 170
Lusiani, A.,
S08-CT-09, 383
Lutero, D. S.,
S10-P-08, 529
Lv, Y. Y.,
S03-P-06, 227

Ma'rufi,
S01-P-14, 149
S01-P-51, 173
Mañibo, C. N.,
S03-CT-01, 217
Maderal, L. D.,
S01-P-04, 143
Maf'ulah, S.,
S01-P-12, 148
Magadia, J.,
S09-CT-43, 460
Magdalena, I.,
S09-CT-18, 446
Magfirawaty,
S09-CT-42, 460
Magsakay, C. B.,
S08-CT-06, 382
Mahapatra, C.,
S09-P-23, 495
Mahatma, T.,
S07-CT-34, 324
S07-P-27, 349
Mahatma, Y.,
S02-CT-40, 201
Mahkya, D. A.,
S07-CT-24, 318
Mahmud, S. L.,
S05-CT-30, 272
Mahmudah, M.,

S08-P-30, 429
Malik, M.,
S07-CT-50, 333
Mamahit, D. A.,
SL-02, 126
Mamaril, M. C. C.,
S08-CT-21, 390
Mamat, M.,
S09-P-22, 494
Mame, N. M.,
S08-CT-01, 379
Mampouw, H. L.,
S01-P-46, 170
Manchanda, R.,
S09-P-23, 495
Mangku, I W.,
S07-IT-05, 303
Manullang, L. S. J.,
S01-P-26, 157
S01-P-28, 158
S01-P-49, 172
Manurung, M. M.,
S01-P-19, 152
Manutami, T.,
S07-P-43, 357
Manyuen, C.,
S02-CT-13, 188
Mao, H.,
S08-CT-22, 390
Mar, O.,
S03-CT-13, 223
Marcelo, R. M.,
S08-P-09, 417
Mardiana, N.,
S08-P-36, 432
Mardiyana,
S04-CT-25, 244
S10-CT-06, 517
Mardlijah,
S10-CT-15, 522
S10-P-11, 530
Marin-Sanguino, A.,
S09-CT-02, 436
Marjono,
S03-P-02, 224
Markin, A.,
S01-CT-02, 131
Marron, S.,
S10-IT-04, 513
Maruddani, D. A. I.,
S01-P-35, 162
Mashitasari, D.,
S06-P-02, 297
Mashuri, M.,
S01-P-50, 172
Masjkur, M.,
S07-CT-01, 305
Masri, R.,
S02-IT-06, 181
Masta, Al A.,
S04-CT-27, 245
Maulana, H. A.,
S07-CT-12, 312
Maulidi, I.,
S06-CT-07, 292
Maynard, J.,
PL-01, 121
McGree, J.,
S07-CT-36, 325
Meganingtyas, D. E. W.,
S08-CT-54, 409
Melanie,
S09-CT-13, 443
Menaria, N.,
S04-P-08, 248
Mendoza, E. R.,
S09-CT-02, 436
Mendoza, E.,
S09-CT-05, 438
Mendoza, G. A.,
S10-P-08, 529
Mendoza, R.,
S10-CT-07, 517
Meng, J.,
S09-P-31, 500
Mengersen, K.,
S07-CT-36, 325
Mentari, A.,
S01-P-41, 167
Merino, D. I.,
S02-CT-07, 185
Mihara, T.,
S02-IT-03, 180
Milasari, M. D.,
S08-P-31, 429
Miranda, I. K. P.,
S08-CT-06, 382
Miro, E. D. P.,
S08-CT-21, 390
Miro, E. D.,
S02-CT-22, 192
Mishra, A. M.,
S04-P-09, 249
Mishra, B. K.,
S09-P-43, 507
Mishra, B.,
S09-CT-27, 452
Mishra, S. K.,
S10-CT-10, 519
Mizoguchi, Y.,
S09-CT-74, 479
Mkaouar, M.,
S02-CT-43, 203
Mohamad, A. Q.,
S09-CT-14, 443
S09-CT-15, 444
S09-CT-54, 466
Mohamed, A. N.,
S01-P-37, 164
Mohammad, R. Z.,
S06-P-06, 299
Mohammad, S. A.,
S02-CT-04, 183
S02-IT-06, 181
Mojdeh, D. A.,
S08-CT-27, 393
Mtarneh, S.,
S08-CT-27, 393
Mubarok, N.,
S02-P-11, 210
Mucharam, L.,
S05-P-08, 281
Muchlis, A.,
S09-CT-73, 478
Muchtadi-Alamsyah, I.,
S02-CT-18, 191
S02-CT-19, 191
S02-CT-28, 195
S02-CT-31, 197
S02-CT-37, 200
S02-CT-40, 201
S09-CT-73, 478
Muchtar, S.,
S07-P-22, 346
Muhaemin, I. A.,
S10-P-13, 531
Muin, A.,

S01-P-53, 174
Mukdasai, K.,
S05-CT-23, 268
S05-P-01, 278
Mukhaiyar, U.,
S07-CT-06, 308
Mukhamediyeva, A.,
S01-P-01, 141
Mukhlash, I.,
S09-CT-53, 465
S09-CT-62, 471
Mukhni,
S01-P-36, 163
Mukhsar,
S09-CT-59, 470
Muksar, M.,
S01-P-16, 151
Mulyati, S.,
S01-P-27, 157
S01-P-58, 177
Mulyono,
S08-CT-56, 410
Muminov, M. I.,
S09-CT-48, 463
Mungkasi, S.,
S06-CT-04, 290
Muradi, H.,
S09-IT-04, 434
Murid, A. H. M.,
S09-CT-48, 463
Murnaka, N. P.,
S01-P-20, 153
S01-P-29, 159
S01-P-30, 159
S01-P-41, 167
S01-P-54, 175
S01-P-56, 176
Mursaleen, M.,
S04-IT-03, 229
Musdalifah, S.,
S08-CT-30, 395
Mushi, A. R.,
S10-CT-13, 521
Mínguez, A.,
S02-IT-01, 179

Nabila, S.,
S08-P-11, 418
Nable, J. A.,
S03-CT-01, 217
Nabong, J. R.,
S09-CT-60, 470
Naim, S.,
S07-P-65, 370
Nakharutai, N.,
S10-P-09, 530
Nakprasit, K. M.,
S03-CT-10, 222
Nam, S. Y.,
S08-P-07, 416
Naqvi, S. M. R. S.,
S05-CT-19, 266
Nasir, N. M.,
S09-CT-54, 466
Nasution, D.,
S02-CT-01, 182
S02-CT-28, 195
Natalya, L.,
S01-P-50, 172
Nawaz, R.,
S06-CT-01, 289
Netti, S.,
S01-P-27, 157
Ngurah, A. A. G.,
S08-CT-38, 399
Nguyen, B. V.,
S02-CT-09, 186
Nguyen, D. C.,
S05-IT-02, 252
Nguyen, Q. M.,
S06-CT-03, 290
Nguyen, Q. V.,
S10-P-03, 526
Nguyen, T. B.,
S09-CT-17, 445
Niken, J.,
S07-CT-21, 317
Nilakusmawati, D. P. E.,
S01-P-25, 156
Nindita, K.,
S10-CT-08, 518
Ningrum, W. S.,
S07-P-33, 352
Ningtyas, R. A.,
S09-CT-49, 463
Niniwati,
S01-P-48, 171
Nofrianti,
S01-P-19, 152
Noorani, M. S. Md,
S05-IT-04, 254
Nordin, S. Z.,
S10-P-02, 525
Noto, M. S.,
S01-P-42, 167
Notodiputro, K. A.,
S07-P-06, 337
Noviyanti, L.,
S07-P-40, 356
Novkaniza, F.,
S07-CT-50, 333
Nugrahani, E. H.,
S05-CT-30, 272
S05-P-04, 279
Nugroho, B. S.,
S01-P-23, 155
Nugroho, D. B.,
S07-P-27, 349
Nugroho, S.,
S07-CT-27, 320
Nuraiman, D.,
S09-CT-04, 438
Nurdiati, S.,
S07-P-28, 350
Nurfarisha,
S07-CT-04, 307
Nurhasanah, F.,
S01-P-57, 177
Nurrsamsi, I.,
S09-CT-75, 480
Nursalim, R.,
S09-CT-03, 437
Nurul, D.,
S05-IT-07, 255
Nurwantoro, P.,
S09-CT-06, 439
Nusantara, T.,
S01-P-11, 147

Oh, Y. T.,
S08-P-07, 416
Ohta, S. I.,
S03-IT-01, 213
Ohwada, H.,
S07-CT-21, 317
Okosun K. O.,
S05-CT-33, 274

Oktaviano, E.,
S07-P-25, 348
Ong, K. L.,
S02-CT-21, 192
Ong, W. E.,
10-CT-12, 520
Osada, H.,
S07-IT-04, 302
Oscandar, H. F.,
S09-CT-75, 480
Otok, B. W.,
S07-P-38, 355
Ozawa, N.,
PL-04, 123

Padli, F.,
S09-P-42, 506
Padma, H.,
S05-CT-39, 277
S10-CT-02, 514
Padmadisastra, S.,
S07-CT-09, 310
Pagalay, U.,
S05-P-15, 285
Pajimola, A. K.,
S05-CT-38, 276
Pak, A.,
S09-CT-19, 447
Palupi, D. J. E.,
S02-P-07, 208
Palupi, R.,
S08-P-13, 419
Pambekti, G. B.,
S09-CT-26, 451
Pandiangan, H.,
S09-CT-67, 474
Pane, R.,
S07-CT-40, 327
Panthi, D.,
S04-CT-13, 238
Paras, A. T.,
S02-CT-07, 185
Parhusip, H. A.,
S09-P-16, 491
S09-P-17, 492
Park, J.,
S04-IT-02, 229
Park, S.,
S04-CT-22, 243
Parmar, R. K.,
S04-P-13, 250
Parmikanti, K.,
S05-P-13, 283
S07-P-41, 356
S07-P-42, 357
Parta, I N.,
S01-P-11, 147
Pasaribu, U. S.,
S07-CT-12, 312
S07-P-26, 348
Pathuddin,
S01-P-06, 144
Paulus, E.,
S09-P-26, 498
Peleg, A.,
S06-CT-03, 290
Pelias, J. G. P.,
S03-CT-06, 220
Peng, J.,
S08-CT-57, 410
Penullar, C. M. R.,
S08-CT-06, 382
Permana, D.,
S07-P-26, 348
Permana, F. C.,
S09-CT-25, 450
S09-P-18, 492
Permana, F. J.,
S07-P-13, 340
Petalcorin, G.,
S02-CT-30, 196
Petalcorin, Jr. G. C.,
S02-CT-46, 205
Pham, D. T.,
S09-CT-33, 455
Phang, P.,
S05-CT-05, 258
Phetpradap, P.,
S10-P-09, 530
Phu, H. X.,
S10-IT-01, 511
Pilar-Arceo, C.,
S09-CT-05, 438
Pimentel, J. S.,
S06-P-07, 300
Pirzada, S.,
S08-CT-13, 385
Platil, L.,
S02-CT-24, 193
Poerwanto, B.,
S09-P-42, 506
Pooja,
S09-CT-41, 459
Poomsa-Ard, T.,
S02-CT-13, 188
Poovanandran, G.,
S09-P-37, 503
Pornel, J. B.,
S01-P-13, 149
Pornprakun, W.,
S10-P-07, 529
Pradjaningsih, A.,
S10-P-01, 525
Prahmana, R. C. I.,
S01-CT-08, 135
Prajapati, A.,
S09-P-43, 507
Prasattong, S.,
S10-P-07, 529
Prasetyo, P. W.,
S02-CT-05, 184
Prasetyorini,
S05-CT-34, 274
S07-P-25, 348
Prastiwi, D.,
S08-P-24, 425
Prastyo, D. D.,
S07-CT-43, 329
S07-P-53, 362
S07-P-62, 368
Pratiwi, H.,
S07-CT-22, 317
Pratiwi, M.,
S01-P-40, 166
Pratomo, Y.,
S07-P-27, 349
Prayoga, I G. S. A.,
S07-P-64, 369
Prihandoko, A. C.,
S08-CT-53, 408
Prihatnani, E.,
S01-P-45, 169
Privault, N.,
S07-IT-06, 304
Priyadarshana, W. J. R. M.,
S10-CT-11, 519

Priyambodo, T. K.,
S09-CT-06, 439
Purhadi,
S07-CT-15, 313
S07-CT-43, 329
Purnaba, G. P.,
S07-P-28, 350
Purnami, S. W.,
S07-P-52, 362
Purnami, S.,
S07-P-72, 373
Purnomo, K. D.,
S08-CT-54, 409
S08-P-28, 428
S08-P-30, 429
Purohit, R.,
S04-P-02, 246
Purohit, S. D.,
S04-P-07, 248
Purwadi, J.,
S07-P-48, 360
Purwandari, T.,
S07-P-47, 359
Purwanto, S. E.,
S01-P-59, 178
Purwasih, I. A.,
S08-CT-26, 393
Puspitar, N. P.,
S02-P-10, 210
Putra, B. C.,
S09-CT-62, 471
Putra, Q. A.,
S01-P-20, 153
S01-P-54, 175
Putri, D. E.,
S07-CT-43, 329
Putri, E. R. M.,
S06-P-02, 297
S06-P-03, 297
S06-P-04, 298
S10-CT-01, 514
Putri, E.,
S07-CT-11, 311
Putro, S. P.,
S05-CT-37, 276
Pyo, J.,
S03-CT-05, 219
S03-CT-11, 222

Qian, Z.,
S07-IT-03, 302
Qomariasih, N.,
S07-P-20, 344

Röllin, A.,
S07-IT-07, 304
Rabago, J. F. T.,
S02-CT-12, 188
S04-CT-19, 241
S04-CT-23, 243
S09-CT-30, 453
Rabajante, J. F.,
S09-CT-10, 441
Rachmaputri, G.,
S05-P-18, 286
Rachmasari, A. R.,
S08-CT-35, 398
Rad, N. J.,
S08-CT-04, 381
S08-CT-20, 389
Rahadjeng, B.,
S08-P-03, 413
Rahayu, S. P.,
S07-P-64, 369
Rahmadani, D.,
S08-CT-31, 395
Rahmadi, A. Z.,
S01-P-15, 150
Rahman, A.,
S10-CT-12, 520
Rahman, B.,
S01-P-26, 157
S01-P-28, 158
S01-P-49, 172
Rahman, I. S.,
S01-P-20, 153
S01-P-29, 159
Rahmat, I. S.,
S09-CT-26, 451
Rahmat, R. W.,
S09-P-34, 502
Rais, Z.,
S07-P-60, 366
Rajah, A.,
S02-IT-07, 181
Rakhmadi, A. A.,
S01-P-43, 168
Ramadhan, R B.,
S09-P-21, 494
Ramli, K.,
S09-CT-42, 460
Ramli, M.,
S06-CT-06, 291
Ramli, N. A.,
S10-P-02, 525
Rara, H. M.,
S04-CT-06, 235
Rathie, A. K.,
S04-P-06, 247
Ratna, E.,
S05-P-16, 285
Ratnasari, V.,
S07-CT-15, 313
Ratu, N.,
S01-P-45, 169
Rawi, N. A.,
S09-CT-47, 462
S09-CT-56, 468
S09-CT-69, 476
Razak, F. A.,
S01-P-37, 164
Redjeki, S.,
S07-CT-37, 326
Rejito, J.,
S07-P-24, 347
S09-P-18, 492
S09-P-20, 493
Remillion, M.,
S09-CT-39, 458
Resty, D.,
S08-CT-51, 407
Reyna, J. A. E.,
S04-CT-20, 241
Rhani, N. A.,
S02-CT-14, 189
Riaman,
S07-P-45, 358
Ribal, A.,
S05-CT-07, 259
Rimadhany, R.,
S08-P-34, 431
Rinurwati,
S08-P-08, 416
Rishmany, G. S.,
S05-P-02, 278
Risnawita,
S02-P-13, 211

Risqi S.,
S09-P-35, 502
S09-P-36, 503
Riyadi,
S04-CT-25, 244
S10-CT-06, 517
Riyanti, R. A.,
S09-P-40, 505
Roh, J.,
S04-CT-09, 237
Rohaeti, E.,
S05-CT-34, 274
S07-P-25, 348
Rohmah, M.,
S07-P-19, 344
Roopkumar, R.,
S04-CT-04, 233
Roque, M. P.,
S06-P-07, 300
Rosadi, D.,
S05-P-17, 286
S07-CT-03, 307
S07-CT-37, 326
S07-P-07, 337
S10-P-05, 527
Rosadi, R.,
S09-P-10, 488
S09-P-18, 492
S09-P-47, 509
Rosario, J. B.,
S08-CT-42, 402
Rosdiana, S.,
S09-CT-26, 451
Rosmaini,
S08-CT-11, 384
Rosmansyah, Y.,
S09-CT-25, 450
Rosmely,
S05-P-04, 279
Rosyadah, M.,
S07-CT-25, 319
Rosyid, M. F.,
S03-CT-07, 220
S07-CT-04, 307
Rosyida, I.,
S08-CT-57, 410
Roza, P.,
S09-P-21, 494
S09-P-27, 498
Rozi, S.,
S05-CT-12, 262
Ruchjana, B. N.,
S01-P-55, 176
S07-CT-16, 314
S07-CT-26, 320
S07-CT-33, 324
S07-CT-47, 331
S07-P-17, 343
S07-P-24, 347
S07-P-41, 356
S07-P-42, 357
S07-P-45, 358
S07-P-61, 367
S09-P-10, 488
S09-P-13, 490
S09-P-18, 492
S09-P-20, 493
Ruliana,
S07-P-38, 355
Rumlawang, F. Y.,
S04-CT-12, 238
S08-CT-52, 407
Runadi, T.,
S07-P-14, 341
Rustiana, S.,
S07-CT-47, 331
S07-P-61, 367
Rusyaman, E.,
S05-P-13, 283
S07-CT-38, 326

Sa'dijah, C.,
S01-P-58, 177
Saaban, A.,
S06-CT-05, 291
Saefuddin, A.,
S07-P-32, 352
Safitri, D.,
S05-P-14, 284
Safitri, L. I.,
S07-P-62, 368
Saini, M.,
S07-P-50, 361
Salamah, M.,
S07-P-44, 358
Sales, C.,
S09-CT-60, 470
Salindeho, B. M.,
S08-CT-17, 388
Salleh, M. Z.,
S06-CT-14, 296
Salmah,
S03-CT-08, 221
S10-CT-08, 518
Salman, A. N. M.,
S08-CT-05, 382
S08-CT-11, 384
S08-CT-18, 388
S08-CT-49, 406
S08-CT-51, 407
S08-CT-52, 407
S08-P-11, 418
S08-P-12, 419
S08-P-13, 419
Samuel, P. A.,
S07-P-09, 338
Sanh, N. V.,
S02-CT-16, 190
Santos, J. M. B.,
S07-P-58, 365
Santoso, N.,
S07-CT-31, 323
Sanusi, N.,
S07-P-22, 346
Sapiri, H.,
S10-CT-04, 515
Saputra, R.,
S01-P-48, 171
Saputro, S. W.,
S08-CT-09, 383
S08-CT-25, 392
S08-CT-44, 403
S08-P-36, 432
Saragih, R.,
S10-IT-02, 512
Sari, D. I.,
S01-P-05, 143
Sari, D. K.,
S04-CT-02, 232
Sari, K.,
S07-CT-20, 316
Sari, N. P.,
S01-P-26, 157
S01-P-28, 158
S01-P-49, 172
Sari, Y. W.,
S07-CT-39, 327

Sarmin, N. H.,
S02-CT-26, 194
S02-CT-04, 183
S02-CT-14, 189
S02-IT-06, 181
S09-P-46, 509
Sartono, B.,
S07-P-32, 352
Sarumaha, Y.,
S07-CT-21, 317
Sarwinda, D.,
S09-CT-07, 439
S09-CT-50, 464
S09-CT-63, 472
Sasiarini, L.,
S07-P-57, 365
Sasongko, L. R.,
S07-CT-34, 324
S07-P-37, 354
Sathasivam, S.,
S09-P-02, 482
Satria, Y.,
S09-CT-66, 474
Satriawati, G.,
S01-CT-05, 133
Satyaputra, A.,
S01-P-15, 150
Saw, V.,
S10-CT-12, 520
Sawaluddin,
S09-CT-61, 471
Say-awen, A. L. D.,
S03-P-05, 226
Scheicher, K.,
S02-CT-43, 203
Schieweck, F.,
S09-P-33, 501
Schmitt, A. H. W.,
S03-CT-04, 218
Semaničová-Feňovčíková, A.,
S08-CT-31, 395
S08-CT-44, 403
Seo, J. H.,
S09-P-28, 499
Septia, T.,
S01-P-34, 162
Septiyadi, I. W.,
S01-P-15, 150
Septyanto, F.,
S08-CT-59, 412
S08-P-23, 425
Setiana, D.,
S09-P-13, 490
S09-P-20, 493
Setiawan, A.,
S07-P-36, 354
Setiyono, B.,
S09-CT-57, 468
S09-CT-62, 471
S09-CT-65, 473
S09-P-11, 488
Setyanto, G. R.,
S07-P-40, 356
Shafie, S.,
S09-CT-14, 443
S09-CT-15, 444
S09-CT-47, 462
S09-CT-54, 466
S09-CT-56, 468
S09-CT-58, 469
S09-CT-69, 476
S09-P-19, 493
Shah, A.,
S09-CT-31, 454
Shams, Z.,
S08-CT-46, 404
Shanti, M. R. S.,
S09-P-16, 491
Sharma, A.,
S06-CT-08, 292
Sharma, H.,
S06-P-05, 298
Sharma, S.,
S10-CT-03, 515
Shikare, M. M.,
S08-IT-05, 377
Shimizu, S.,
S06-IT-02, 287
Shin, J.,
S09-IT-02, 433
Shin, S. W.,
PL-05, 123
Sholahuddin, A.,
S09-P-15, 491
Shulhany, M. A.,
S08-CT-18, 388
Sianturi, P.,
S05-CT-30, 272
S05-P-04, 279
Siaputra, I. B.,
S01-P-50, 172
Sidarto, K. A.,
S05-CT-04, 257
Sidarto, K.A.,
S07-P-69, 372
Sidi, P.,
S09-P-22, 494
Sidqon, M.,
S05-CT-29, 272
Sifriyani,
S07-CT-41, 328
Sihite, A. B.,
S09-P-32, 501
Sihwaningrum, I.,
S04-P-10, 249
Silaban, D. R.,
S08-CT-10, 384
S10-CT-14, 521
Simanjuntak, R.,
S08-CT-05, 382
S08-CT-32, 396
S08-CT-38, 399
S08-CT-50, 406
S08-P-06, 415
Singh, A.,
S05-P-06, 280
Singh, V. P.,
S05-CT-25, 269
Singh, Y.,
S10-CT-10, 519
Sipayung, S. B.,
S07-CT-47, 331
S07-P-61, 367
Siregar, D. I.,
S07-P-34, 353
Siregar, J.,
S01-P-19, 152
Sison, V.,
S09-CT-39, 458
Siswantining, T.,
S09-P-04, 483
S09-P-39, 504
Siswono, T. Y. E.,
S01-P-03, 142
S01-P-08, 145
S01-P-12, 148

Siswono,T. Y. E.,
S01-P-07, 145
Sitompul, O. S.,
S09-CT-61, 471
Skrzypacz, P.,
S09-P-33, 501
Slamet, I.,
S07-CT-22, 317
S07-CT-49, 333
Slamin,
S08-CT-34, 397
S08-CT-53, 408
S08-P-08, 416
S08-P-28, 428
Smail, L.,
S01-CT-06, 134
S09-CT-71, 477
Soeharyadi, Y.,
S06-CT-02, 289
S06-CT-11, 294
Soemartini,
S07-P-17, 343
Soewono, E.,
S05-P-08, 281
Sofronov, G.,
S10-CT-11, 519
Soleh, A. Z.,
S07-P-40, 356
Solekhudin, I,
S09-P-07, 485
Solekhudin, I.,
S09-CT-70, 476
Som, T.,
S04-CT-18, 241
Somayasa, W.,
S07-P-55, 363
Somsuwan, J.,
S03-CT-10, 222
Srimongkol, S.,
S09-CT-11, 442
S09-CT-34, 456
Sroyer, A.,
S01-P-24, 156
Stephen, C.,
S10-CT-13, 521
Suantai, S.,
S04-IT-07, 231
Subanar,
S09-CT-20, 447
Subanji,
S01-P-11, 147
S01-P-27, 157
Subanti, S.,
S07-CT-07, 309
S07-P-18, 343
Subartini, B.,
S07-CT-16, 314
Subaryanto,
S01-P-31, 160
Subchan,
S10-CT-01, 514
S10-CT-05, 516
S10-P-14, 532
Subedi, B. H.,
S05-P-06, 280
Subekti, R.,
S07-P-68, 371
S07-P-70, 372
Subiono,
S02-CT-41, 201
Sudarsana, I W.,
S08-CT-30, 395
Sudiarsa, I W.,
S07-P-52, 362
Sudirman,
S01-P-27, 157
Sugeng, K. A.,
S08-CT-57, 410
S08-CT-59, 412
S08-P-14, 420
S08-P-15, 420
S08-P-17, 421
S08-P-23, 425
S08-P-24, 425
S08-P-27, 427
Sugiyanto,
S05-P-05, 280
S07-P-56, 364
Suhaila, J.,
S07-CT-48, 332
Suhartono,
S05-P-17, 286
S07-CT-24, 318
S07-P-52, 362
S07-P-62, 368
S07-P-64, 369
S09-CT-20, 447
Suherni,
S09-CT-20, 447
Sukono,
S07-CT-38, 326
S09-P-22, 494
S09-P-41, 506
Sulandari, W.,
S09-CT-20, 447
Sulendra, I. M.,
S01-P-58, 177
Sulistiawati,
S01-CT-16, 140
Sulistyaningrum, D. R.,
S09-CT-57, 468
S09-CT-62, 471
S09-CT-65, 473
S09-P-11, 488
Sulistyaningtyas, T.,
S09-P-27, 498
Sulpiani, R.,
S05-CT-37, 276
Sumalpong, F. R.,
S07-P-39, 355
Sumardi, H.,
S08-CT-56, 410
Sumarjaya, I W.,
S07-CT-10, 310
Sumarsa, A.,
S05-CT-34, 274
Sumarti, N.,
S05-CT-22, 268
Sumesh, K.,
SL-01, 126
Summaprab, P.,
S02-P-04, 207
Sun, D.,
S10-IT-04, 513
Sun, H. M.,
S08-P-02, 413
Sunder, V. S.,
SL-01, 126
Sunengsih, N.,
S07-CT-09, 310
Sungkawa, R. O.,
S01-P-31, 160
Sungnul, S.,
S10-P-07, 529
Sunjay,
S09-P-01, 481
S09-P-09, 487

Supama,
S04-CT-16, 240
S04-CT-21, 242
Supandi, E.,
S10-P-05, 527
Supangken, S.,
S08-CT-07, 382
Suparman,
S07-P-02, 334
Suparta, I N.,
S08-P-21, 424
Supartini, E.,
S07-P-41, 356
Suparwanto, A.,
S03-CT-08, 221
Supian, S.,
S07-CT-38, 326
S09-CT-75, 480
S09-P-22, 494
S09-P-41, 506
Suprajitno, H.,
S08-P-08, 416
S10-P-01, 525
Suprayogi,
S07-P-26, 348
Supriatna, A. K.,
S02-P-02, 206
S02-P-03, 207
S09-CT-13, 443
S09-P-24, 496
S09-P-45, 508
Supriatna, A.,
S07-P-45, 358
Suprijadi, J.,
S07-CT-09, 310
Suprijanto, D.,
S08-CT-26, 393
S08-CT-29, 394
S09-CT-73, 478
Supriyadi, Y.,
S07-P-66, 370
S07-P-67, 371
Surgandini, A.,
S01-CT-16, 140
Surodjo, B.,
S02-CT-27, 195
Suryadi,
S09-CT-42, 460
Suryadi, D.,
S01-P-53, 174
Suryadi, M. T.,
S09-CT-66, 474
Suryamah, E.,
S07-P-41, 356
Suryani, M.,
S09-P-24, 496
S09-P-25, 497
S09-P-26, 498
Suryanto, A.,
S05-CT-17, 265
S05-P-12, 283
Suryawan, H. P.,
S07-CT-18, 315
S07-P-54, 363
Suryawati, G.,
S09-IT-04, 434
S09-P-05, 484
Susanti, B. H.,
S08-CT-05, 382
S09-CT-52, 465
S09-P-32, 501
Susanti, D.,
S07-P-45, 358
S09-P-41, 506
Susanto, B.,
S07-P-36, 354
S07-P-37, 354
Susanto, H.,
S06-IT-01, 287
Susilawati,
S08-CT-50, 406
Susilawati, M.,
S01-P-25, 156
Susilowati, L.,
S08-CT-34, 397
Sutanto, H. T.,
S07-P-12, 340
Sutarman,
S07-CT-40, 327
Sutawidjaja, A.,
S01-P-16, 151
S01-P-27, 157
Sutikno,
S07-CT-15, 313
S07-CT-31, 323
S07-P-53, 362
Sutopo,
S02-CT-08, 185
Sutrisno,
S10-CT-18, 524
Suwarsono, St,
S01-P-46, 170
Suwilo, S.,
S08-CT-56, 410
Swalaganata, G.,
S09-CT-65, 473
Sy, P. W.,
S05-CT-21, 267
S05-CT-26, 270
Syahrir, N. H. A.,
S07-P-20, 344
Syarifuddin, A.,
S02-CT-19, 191
Syed Jamaludin, S. S.,
S07-P-51, 361
Sylviani, S.,
S02-P-02, 206
S02-P-03, 207
Syofyan, D. K.,
S08-CT-33, 397
Syuhada, K. I. A.,
S07-P-71, 373
Syukriani, A.,
S01-P-07, 145
Sze, S. N.,
S09-P-06, 485
S09-P-08, 486

Tôn TẠ, V.,
S07-CT-46, 331
Ta, D. P.,
S01-CT-10, 136
Tabaranza, G. F.,
S02-CT-10, 186
Tadić, M.,
S02-IT-01, 179
Taganap, E. C.,
S03-P-04, 225
Taib, B. M.,
S09-CT-37, 457
Tampis, R. L.,
S07-P-11, 339
Tan, C. P.,
S07-P-04, 336
Tan, L. Y.,
S08-P-22, 424
Tan, S. P.,

S03-IT-03, 215
Tan, Y. T.,
S02-IT-06, 181
Tangsiridamrong, P.,
S05-CT-23, 268
Tariboon, J.,
S05-IT-05, 254
Tarmidzi, M. D.,
S08-CT-54, 409
Tasman, H.,
S05-CT-12, 262
S05-CT-16, 265
S05-CT-39, 277
S09-CT-68, 475
S10-CT-02, 514
Teck, G. W.,
PL-07, 124
Teh, W. C.,
S08-CT-28, 394
S09-CT-38, 458
S09-P-37, 503
Teng, T. R. Y.,
S04-CT-07, 235
Teo, M. G.,
S09-P-08, 486
Teoh, Z. Y.,
S08-CT-28, 394
Thamrin, S. A.,
S07-CT-17, 314
S07-CT-36, 325
Thamrongthanyalak, A.,
S01-IT-02, 129
Thanh, D. T.,
S05-CT-28, 271
Thi, H. T.,
S02-CT-45, 204
Tho, N. H.,
S06-CT-15, 296
Thomas, D. K.,
S03-P-02, 224
Thuswaldner, J. M.,
S02-CT-43, 203
Tilukay, M. I.,
S08-CT-49, 406
S08-CT-52, 407
Tiong, W. K.,
S09-P-06, 485
S09-P-08, 486
Tirado, M. A. C.,
S05-CT-21, 267
Tiwari, V.,
S04-CT-18, 241
Tjahjana, R. H.,
S10-CT-18, 524
Tobiska, L.,
S09-P-33, 501
Toh, K. C.,
S10-IT-04, 513
Toharudin, T.,
S07-P-66, 370
S07-P-67, 371
Tomar, A.,
S04-P-01, 245
S05-CT-25, 269
Tomasouw, B. P.,
S09-P-12, 489
Torrisi, G. L.,
S07-IT-06, 304
Tovar, L. M.,
S01-CT-11, 137
S04-P-05, 247
Tran, T.,
S09-CT-33, 455
Tridiana M, L.,
S10-P-04, 526
Trimarsanto, H.,
S09-P-03, 483
Tripathi, J. P.,
S05-CT-32, 273
Trisilowati,
S05-CT-09, 261
S05-CT-17, 265
Tristanti, L. B.,
S01-P-16, 151
Tristono, T.,
S05-CT-29, 272
S09-CT-29, 453
Tubay, J. M.,
S09-CT-10, 441
S09-CT-51, 465
Tubera, D.,
S05-CT-38, 276
Tulas, J. L. L.,
S08-CT-48, 405
Tulus,
S09-CT-61, 471
Turaev, S.,
S09-P-46, 509
Turalba, A. S.,
S08-CT-48, 405
Tuwankotta, J. M.,
S06-CT-11, 294

Ubadah,
S10-CT-14, 521
Ulama, B. S. S.,
S07-CT-23, 318
S07-CT-24, 318
S07-CT-32, 323
S07-P-44, 358
S07-P-46, 359
Ullah, I.,
S09-CT-58, 469
Unson, J. C. P.,
S01-CT-07, 134
Urrutia, J. D.,
S07-CT-45, 330
S07-P-11, 339
Usman,
S01-P-08, 145
Utami, H.,
S07-P-08, 338
Utami, N. T.,
S06-P-04, 298
Utomo, P.,
S09-CT-29, 453
Utomo, T. A.,
S02-CT-37, 200
Utoyo, M. I.,
S08-CT-34, 397
Uttunggadewa, S.,
S08-CT-10, 384
S08-CT-32, 396
S08-P-06, 415

Vîlcu, G. E.,
S03-CT-03, 218
Valdez, M. T. C. C.,
S01-P-04, 143
Vallejo, L. J.,
S04-P-11, 249
Vallejos, M. C.,
S09-CT-64, 472
van de Vrugt, N.M.,
S07-CT-14, 313
Velasco, A. C. T.,
S09-CT-64, 472

Velasco, G. A.,
S04-P-14, 251
Velasco, J. F. A.,
S08-CT-06, 382
Veng, S.,
S10-CT-09, 518
Verdiana, M.,
S07-P-35, 353
Vikade, W. D.,
S08-P-28, 428
Vilela, J. P.,
S02-CT-10, 186
Virgantari, F.,
S07-P-05, 336
Vladislavleva, K.,
S01-CT-02, 131
Volkov, A.,
S01-CT-10, 136
Vu, V. H.,
PL-08, 125
Vyas, V. K.,
S04-P-02, 246

Wahyuni, H.,
S07-CT-37, 326
Wahyuni, S.,
S02-CT-03, 183
S02-CT-08, 185
S02-CT-23, 193
S02-CT-29, 196
S02-P-11, 210
Wahyuni, Y.,
S01-P-33, 161
Wahyuniningsih, N.,
S07-CT-11, 311
Waliyanti, I. K.,
S03-CT-07, 220
Wallace, E.,
S02-CT-02, 182
Wang, S. H.,
S05-CT-06, 259
Wang, T. M.,
S08-CT-41, 401
Wanless, I.,
S08-IT-01, 375
Wardana, R. W.,
S01-P-31, 160
Wardani, D.,
S05-CT-11, 262
Wardhana, I G. A. W.,
S02-CT-31, 197
Wati, W. F. A.,
S05-P-15, 285
Wei, D.,
S09-CT-19, 447
Weku, W.,
S09-CT-76, 480
Welyyanti, D.,
S08-CT-32, 396
Werry, F.,
S07-P-69, 372
White, N.,
S07-CT-36, 325
Wibawa, G. N. A.,
S07-P-55, 363
Wibawa, K. A.,
S01-P-11, 147
Wibowo, W.,
S07-P-38, 355
Widjaja, J.,
S06-CT-02, 289
Widodo,
S05-CT-08, 260
S08-CT-57, 410
S08-P-27, 427
Widodo, B.,
S09-CT-03, 437
S09-CT-36, 457
S09-CT-45, 461
S09-CT-49, 463
Widowati,
S05-CT-37, 276
S10-CT-18, 524
Widyaningsih, Y.,
07-P-34, 353
S07-P-09, 338
S07-P-14, 341
S07-P-15, 342
S07-P-33, 352
S07-P-35, 353
Wijaya, I G. E. P.,
S09-CT-36, 457
Wijaya, K.,
S08-CT-29, 394
Wijaya, R. W. N.,
S08-CT-37, 399
Wijayanti, H.,
S07-P-05, 336
Wijayanti, I. E.,
S02-CT-03, 183
S02-CT-05, 184
S02-CT-08, 185
S02-CT-23, 193
S02-CT-27, 195
S02-CT-29, 196
S02-CT-44, 203
S03-CT-07, 220
S08-P-27, 427
Wijayanto, Z.,
S01-P-10, 146
Winarni,
S10-P-14, 532
Winarsih, D.,
S08-CT-30, 395
Windarta, S.,
S09-P-35, 502
S09-P-36, 503
Windarto,
S05-CT-10, 261
Winnan, G. A. J. C.,
S01-CT-07, 134
Wiryanto, L. H.,
S06-CT-04, 290
Wiwatanapataphee, B.,
S05-CT-05, 258
Wong, V. K. G.,
S02-P-08, 209
Wu, J.,
S09-CT-21, 448
S09-CT-28, 452
Wu, T. P.,
S09-CT-32, 455
Wu, Y. H.,
S05-CT-05, 258
Wulan, E. R.,
S10-P-13, 531
Wulandari, N. I.,
S08-CT-54, 409
Wulandari, S.,
S09-P-39, 504
S09-IT-04, 434
S09-P-04, 483
Wuryandari, T.,
S01-P-35, 162
Wyrasti, A. F.,
S01-P-58, 177

Xiangyu, Z.,
PL-09, 125
Xing, C.,
S09-IT-03, 434

Yaafar, A.,
S07-P-65, 370
Yadav, S.,
S06-CT-09, 293
Yagi, A.,
S07-CT-46, 331
Yamamoto, Y.,
S07-CT-46, 331
Yang, M. S.,
S09-CT-76, 480
Yang, Y.,
S01-IT-01, 128
Yong, B.,
S07-CT-29, 322
Yoshimura, J.,
S09-CT-51, 465
Yoshinaga, M.,
S08-IT-04, 377
Yosman, A. F.,
S09-P-46, 509
Yulianti, K.,
S05-P-08, 281
Yulianti, N.,
S02-P-14, 211
Yulita, I. N.,
S09-P-48, 510
Yunianta, T. N. H.,
S01-P-21, 154
Yuniarti, N.,
S01-P-30, 159
Yunus, A. A. M.,
S07-P-10, 339
Yurniwati,
S01-P-02, 142
Yusof, F.,
S07-CT-48, 332
Yusop, Z.,
S07-CT-48, 332
Yuwanda, A.,
S05-CT-14, 263
Yuwaningsih, D. A.,
S02-CT-03, 183
Yuwono, I.,
S01-CT-01, 131

Zabid, M F. M.,
S05-CT-40, 277
Zahroh, M.,
S09-P-07, 485
Zambrano, A.,
S02-CT-22, 192
Zambrini, J. C.,
S07-IT-02, 302
Zamri, S. N. A.,
S02-CT-26, 194
Zeidan, D.,
S09-CT-16, 445
Zhang, R.,
S08-IT-02, 376
Zhang, Y.,
S03-IT-03, 215
Zhao, D.,
S04-CT-02, 232
Zhexembay, L.,
S09-CT-19, 447
Zin, N. A. M.,
S09-CT-14, 443
S09-CT-15, 444
Zukhronah, E.,
S07-P-56, 364
Zulfaneti,
S01-P-36, 163
Zulijanto, A.,
S04-CT-21, 242

Other Information

Committees

Hosted by

- IndoMS (Indonesian Mathematical Society)
- SEAMS (South East Asian Mathematical Society)

Organized by

- ITB (Institut Teknologi Bandung)
- Unpad (Universitas Padjadjaran)
- UGM (Universitas Gadjah Mada)
- UI (Universitas Indonesia)
- UNUD (Universitas Udayana)

Supported by

- Ministry of Research, Technology and Higher Education Indonesia
- CIMPA - Centre International de Mathématiques Pures et Appliquées
- KMS - Korean Mathematical Society
- MSJ - Mathematical Society of Japan
- KIAS - Korea Institute for Advanced Study
- IMU - International Mathematical Union
- Committee for Women in Mathematics

Co-Chairs

- Edy Tri Baskoro, Institut Teknologi Bandung
- Budi Nurani Ruchjana, Universitas Padjadjaran
- Sri Wahyuni, Universitas Gadjah Mada
- Kiki A. Sugeng, Universitas Indonesia

General Secretary

- Intan Muchtadi, Institut Teknologi Bandung

Committees

Steering Committee

- Edy Tri Baskoro, Institut Teknologi Bandung, Indonesia
  President of SEAMS (Chair)
- Hyungju Park, International Mathematical Union (IMU)
- C. Herbert Clemens, International Mathematical Union
- Budi Nurani, President of Indonesian Mathematical Society
- Liqun Zhang, General Secretary of Chinese Mathematical Society
- Motoko Kotani, President of Mathematical Society of Japan
- Yong-Hoon Lee, President of Korean Mathematical Society
- BN. Waphare, Representative of Indian Mathematical Society
- Ling San, President of Singapore Mathematical Society
- Le Tuan Hoa, VIASM, Vietnam

Scientific Committee

- Budi Nurani Ruchjana, Unpad, Indonesia (Chair)
- Intan Muchtadi, Institut Teknologi Bandung, Indonesia (Co-chair)
- Srinivasan Kesavan, International Mathematical Union
- Polly W. Sy., International Mathematical Union
- Dohan Kim, Seoul National University, Korea
- Fidel Nemenzo, University of the Philippines Diliman
- Wanida Hemakul, Chulalongkorn University, Thailand
- Zhu Chengbo, National University of Singapore
- Rosihan M. Ali, Universiti Sains Malaysia
- Maslina Darus, Universiti Kebangsaan Malaysia
- Leo H. Wiryanto, Institut Teknologi Bandung, Indonesia
- Zulkardi, Universitas Sriwijaya, Indonesia
- SEAMS Council Members

Program Committee

- Intan Muchtadi (Institut Teknologi Bandung) - Chair
- Ikha Magdalena (Institut Teknologi Bandung)
- Indah Emilia Wijayanti (Universitas Gadjah Mada)
- Hizir Syofyan (Universitas Syiah Kuala)
- Rinovia Simanjuntak (Institut Teknologi Bandung)
- Mashadi (Universitas Riau)
- Irwan Endrayanto (Universitas Gadjah Mada)
- Slamin (Universitas Jember)
- Yaya S. Kusumah (Universitas Pendidikan Indonesia)
- Agus Suryanto (Universitas Brawijaya)
- Utriweni Mukhaiyar (Institut Teknologi Bandung)
- Marjono (Universitas Brawijaya)
- Hasmawati (Universitas Hasanuddin)
- Marwan (Universitas Syiah Kuala)
- Ema Carnia (Universitas Padjadjaran)
- Mardiyana (Universitas Sebelas Maret)
- Eridani (Universitas Airlangga)
- Dadan Kusnandar (Universitas Tanjung Pura)
- Ratu Ilma Indra Putri (Universitas Sriwijaya)
- Kristiana Wijaya (Universitas Jember)
- Alhadi Bustamam (Universitas Indonesia)
- Jalina Wijaya (Institut Teknologi Bandung)
- S. Sariyasa (Universitas Pendidikan Ganesha)
- Thomas Pentury (Universitas Pattimura)
- Yudi Soeharyadi (Institut Teknologi Bandung)
- Widowati (Universitas Diponegoro)
- Salmah (Universitas Gadjah Mada)
- Gustina Elfiyanti (Universitas Islam Negeri Jakarta)
- Topan Eko Raharjo (Institut Teknologi Bandung)

Organizing Committee

- Sri Wahyuni (Universitas Gadjah Mada) - Chair
- Ch. Rini Indrati (Universitas Gadjah Mada)
- Kiki A. Sugeng (Universitas Indonesia)
- Edi Cahyono (Universitas Halu Oleo)
- Gunardi (Universitas Gadjah Mada)
- Komang Dharmawan (Universitas Udayana)
- Diah Chaerani (Universitas Padjadjaran)
- Wikaria Gazali (Universitas Bina Nusantara)
- Tjokorda Bagus Oka (Universitas Udayana)
- Ketut Budayasa (Universitas Negeri Surabaya)
- Syafrizal Sy. (Universitas Andalas)
- G. K. Gandhiadi (Universitas Udayana)
- Saladin Uttunggadewa (Institut Teknologi Bandung)
- Erma Suwastika (Institut Teknologi Bandung)
- Basuki Widodo (Institut Teknologi Sepuluh Nopember)
- Herni Utami (Universitas Gadjah Mada)
- Anang Kurnia (Institut Pertanian Bogor)
- Abdurrahman Asari (Universitas Negeri Malang)
- Idha Sihwaningrum (Universitas Jenderal Sudirman)
- Titin Siswantining (Universitas Indonesia)
- Tulus (Universitas Sumatera Utara)
- Anna Chadidjah (Universitas Padjadjaran)
- Hengki Tasman (Unversitas Indonesia)
- Rudi Rosadi (Universitas Padjadjaran)
- Sisilia Sylviani (Universitas Padjadjaran)
- Nora Hariadi (Universitas Indonesia)
- Fahmi Candra Permana (Universitas Padjadjaran)

SEAMS Council Members

- Ling San (SEAMS President 2016-2017 Nanyang Technological University, Singapore)
- Edy Tri Baskoro (SEAMS President 2014-2015 Institut Teknologi Bandung, Indonesia)
- Yongwimon Lenbury (SEAMS Vice-President 2014-2015 Mahidol University, Thailand)
- Le Tuan Hoa (Institute of Mathematics, Vietnam Academy of Science & Technology, Vietnam)
- Zhu Chengbo (National University of Singapore, Singapore)
- Nguyen Huu Du (Vietnam Institute for Advanced Study in Mathematics Hanoi, Vietnam)
- Budi Nurani (Universitas Padjadjaran, Indonesia)
- Sri Wahyuni (Universitas Gadjah Mada, Indonesia)
- Chan Wai Hong (Honking Institute of Education, Hong Kong)
- Rosihan M. Ali, Dato (Universiti Sains Malaysia, Penang, Malaysia)
- Maslina Darus (Universiti Kebangsaan Malaysia, Selangor, Malaysia)
- Suthep Suantai (Director of CEPMART, Thailand)
- Wanida Hemakul (Chulalongkorn University Bangkok, Thailand)
- Fidel Nemenzo (University of the Philippines, Diliman, Philippines)
- Jose Maria P. Balmaceda (University of the Philippines, Diliman, Philippines)
- K. P. Shum (Editor-In-Chief, Southeast Asian Bulletin of Mathematics, Yunnan University, Kunming, China)
- Chan Roath (Cambodian Mathematical Society, Cambodia)
- Ty Poli Reth (National Institute of Education, Phnom Penh, Cambodia)
- Thein Myint (President, Mathematical Society of Myanmar, Myanmar)
- Saw Win Maung (Joint Secretary, Mathematical Society of Myanmar, Myanmar)
- Nguyen Van Sanh (SEAMS Treasurer 2016-2017 Mahidol University, Thailand)
- Victor Tan (SEAMS Secretary 2016-2017 National University of Singapore, Singapore)

Social Activities

1. Opening Ceremony and Group Photos

Tuesday, July 26	**Pecatu Hall 1 and 2**
09.00 – 10.00	The AMC 2016 will officially begin with an opening ceremony at the Pecatu Hall 1 and 2. All registered participants are cordially invited to attend the ceremony. This opening ceremony will be followed by Plenary Lecture 1 and Special Lecture 1. Please join and celebrate the grand opening of the AMC 2016.

2. Banquet

Wednesday, July 27	**Taman Jepun, Bali BNDCC**
19.00 – 21.00	The banquet dinner will take place at the Taman Jepun. This banquet is organized for participants and registered accompanying persons.

3. Closing Ceremony

Friday, July 29	**Pecatu Hall 1 and 2**
16.30 – 17.00	The closing ceremony will be staged at the Pecatu Hall 1 and 2. This ceremony will be a successful ending of the AMC 2016.

Practical Information

Registration

New Registration during the AMC 2016 will be at the on-site registration counter. Participants who pre-registered will receive a seminar kit and a coupon for banquet after receiving their name cards. The registration counter is located on the 1st floor lobby at Pecatu Foyer Bali Nusa Dua Convention Center, Bali-Indonesia.

Operation hours of the registration office

- July 25 (Mon) : 12.00 – 18.00
- July 26 (Tue) : 08.00 – 09.00
- July 27 (Wed) : 08.00 – 08.30
- July 28 (Thu) : 08.00 – 08.30

Practical Information

Post Office

Location : **Nusa Dua Post Office**, Nusa Dua Main Road, Nusa Dua
Phone : (+62361) 771202
Services : Western Union, Express Mail Service, Stamp, All Postal Services

Other Facilities

1. Souvenir Shops:

- **Art Shops on the Pantai Mengiat Road**

  Upon turning left to Jalan Pantai Mengiat from Jalan Srikandi, you will see rows of small art shops on both sides of the road. These traditional outlets might remind you of those in Kuta, Seminyak, or Denpasar, as they sell same goods such as Bali sarongs, T-shirts, wooden statues, kites, knick-knacks, and many other kinds of souvenirs. The prices, however, are a little higher as this is still in the expensive Nusa Dua area; but bargaining is very welcome and the hard sell system is not common. Comparing prices from door to door is the key to get the best deals.

  Location: Jalan Pantai Mengiat

- **Hardy's Nusa Dua Plaza**

  Hardy's Nusa Dua Plaza is a great alternative for those who think shopping in Nusa Dua is overpriced. Located outside the BTDC complex, Hardy's offers more reasonable prices. The first floor houses a food corner of Indonesian dishes, a fun zone of arcade games, and a supermarket that provides a wide range of goods such as wine, spirits, souvenirs, chocolate, electronics, and much more. On the second floor, you'll find sports equipment, stationery equipment, a kids' toys shop, and a department store that sells local brand-named clothes, shoes, and accessories. Big discounts are sometimes on offer.

  Opening Hours: 08:00 22:30
  Location: Jl. By Pass Ngurah Rai No. 77X, Nusa Dua
  Tel: +62 (0)361 774 639

- **Eling Bali Handicraft Bali Collection**
  Kawasan BTDC Area Bali Collection, Nusa Dua, Jl. Pantai Mengiat
  +62 361 771662

- **Krisna Shop**
  JL Pratama, 93-B, Kuta, 80361 +62 361 77549

2. Hospital and Pharmacies

All the hospitals and medical centers listed below provide interpretation services for foreign patients.

- BIMC Hospital Nusa Dua, Kawasan BTDC Blok D, Nusa Dua 80363, Bali, Indonesia
  Telephone:(+62 361) 3000 911
  FAX:(+62 361) 3001 150
  E-mail: nusadua@bimcbali.com

- Rumah Sakit Surya Husadha Nusa Dua
  Jl. Siligita, Blok I No. 14, Nusa Dua, Kuta Selatan
  Telp : +62 361 775827

- Pharmacy :

  - KIMIA FARMA KUTA
    Jl. Kartika Plaza Kuta, telp 757196
  - KIMIA FARMA TEUKU UMAR
    Jl. Teuku Umar 245 Denpasar, telp 245768
  - KIMIA FARMA NUSA DUA
    Jl. By Pass I gusti Ngurah Rai No 890 Nusa Dua, telp 774118
  - KIMIA FARMA TUBAN
    Jl. Raya Tuban, Kuta, telp 757472

1. Bumbu Bali

Jl. Pratama, Tanjung Benoa, Bali

About This Restaurant:

The extravagant beauty and delights of Bali also extends to its much-celebrated local cuisine. Discovering the tropical island paradise also requires the exploration of its traditional cooking by treating yourself to such delicacies as slow-roasted chickens and ducks in banana leaves; superbly fresh grilled seafood; tantalizing sates; soups from banana stems, green papayas and mushrooms; a large selection

of vegetarian dishes; and an ever changing selection of Balinese cakes; black rice pudding; not forgetting the daily changing selection of tropical fruits found at the local markets. This are just some of the delectable creations, certain to even please the palates of Bali's fabled Gods, that await the gastronomically curious visitor to our beloved Indonesian island.

On the menu you will not find Balinese food commonly served in hotels and tourist restaurants, as it is our aim to serve Balinese food the way you find it prepared in Balinese homes or during traditional ceremonies. We take you on a journey into the culinary delights our island paradise has to offer.

2. Bebek Bengil

BTDC Complex, Nusa Dua Beach, Kuta Sel., Bali, Indonesia

About This Restaurant

The spacious layout of breezy pavilions and multi-level floors that overlook rice fields, fountains and ponds ensure that guests will always have a comfortable place to dine with great views.

The service here is friendly, the food comes out fast, and visitors are free to linger as long as they like. For a feast shared among friends or family, try the Indonesian Rijstafel, a heaping platter of saffron rice, crispy duck, chicken curry, ginger chicken, and Balinese vegetable lawar, all served with an exotic cocktail and finished with coconut cream pie and a tropical fruit plate.

3. Tapa Nusa Dua

Jl. Nusa Dua Selatan, Nusa Dua, Indonesia

This place is never not crowded. The atmosphere is always lively and groovy, the place where you can have legit tapas accompanied with some local beer and your loved ones! Have their Pan Tomate Con Jamon Serano (Rp. 125.000,-) that would tickle your tummy!

4. Blue Ocean Seafood

Jl. Pantai Jimbaran, Jimbaran, Bali

The 3-in-1 dining spot: melt-in-your-mouth seafood, nice atmosphere, and reasonable prices.

The quality of the seafood is top notch.
There's also a group of men with black suits
bringing live music to your table!
What an experience!

5. Menega Cafe

Pantai Muaya, Jl. Four Seasons Resort, Jimbaran, Bali

It totally makes sense why this restaurant is always crowded. They have a complete selection of seafood menu and they all taste delicate and fresh, and not to mention that they are set at very reasonable prices! The prawns and lobsters are fat and so JUICY. The venue is also nicely decorated with bamboo structures and lanterns, making the atmosphere so relaxed yet romantic. I fell in love at the first bite with their fried squid and tasty pan fried kangkung! Legendary!

6. Kedai Ayam Ibu Oki

Jalan Pantai Mengiat, Nusa Dua, Indonesia

This very typical balinese cuisine. The price is very affordable. The place always packed in lunchtime with mostly local and domestic guests. Very tasty food, spicy and affordable only at 20k, its a streetfood kind a thing. They provide halal food mostly from chicken with diffrent taste.

7. Babi Guling Pak Dobiel (Non-halal Food)

Jl. Srikandi no. 9, Nusa Dua, Indonesia

Dobiel is the best Babi guling in Bali. Even, this is not a restaurant, but you must NOT miss this one when you happen to be around Nusa Dua area. This is a compulsory meal.

8. Merah Putih

Jl. Petitenget No. 100 X, Seminyak, Bali

About This Restaurant Indonesian food is typically eaten family style, and we encourage this convivial tradition at Merah Putih. Plates are set in the middle of the table, meaning everyone in your group has the opportunity to sample a range of dishes; they can enjoy the classics and also discover something new. The main dining area seats 110 people comfortably across the main floor and another 24-30 in three teak pods on a mezzanine.

The menu is separated into two sections, each presenting an opportunity to discover a different kind of Indonesian cuisine. In the 'traditional' section, unpretentious, simple cooking procedures highlight the refined balance of regional dishes using specially selected tender meats, locally sourced produce and the very best aromatic spices. In the 'baru' or 'modern' section you'll find imaginative culinary creations, which take as their basis the best of Indonesia's traditional ingredients.

9. Made's Warung

Jl. Raya Seminyak, Banjar Seminyak, Kuta, Kabupaten Badung, Bali, Indonesia

About this restaurant: Mades warung was established in 1969 and has become a social eating and meeting venue for locals, expats and tourists alike. It has grown from a traditional roadside warung into a cosmopolitan restaurant serving a variety of local and international food in Bali.

10. Bebek Tepi Sawah

Jl. Raya Kartika Plaza in Kuta

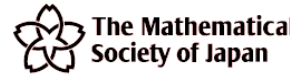
About This Restaurant Located in the heart of Kuta, Bebek Tepi Sawah Restaurant is focusing the business to Kuta shopping lover around Jl. Raya Kartika Plaza in Kuta. To serve our valued customers that have very limit time to travel to Ubud, we provide you the same quality of food with different atmosphere of having meal by the airport, while doing a quick shopping at the Krisna Oleh Oleh Bali to buy souvenirs for your lovely family at home. Enjoy a wide selection of cuisine, ranging from contemporary western and innovative Indonesian or Balinese specialties in a fresh atmosphere within the environment of the real Bali's Village.

Share the joy and satisfaction with other, to feel a wonderful experience of having a meal at corner of the rice field, while viewing the rice paddies and the wave of the coconut tree leaves, as well as listening to the various tiny little bird singing.

Hosted by

Organized by

Supported by



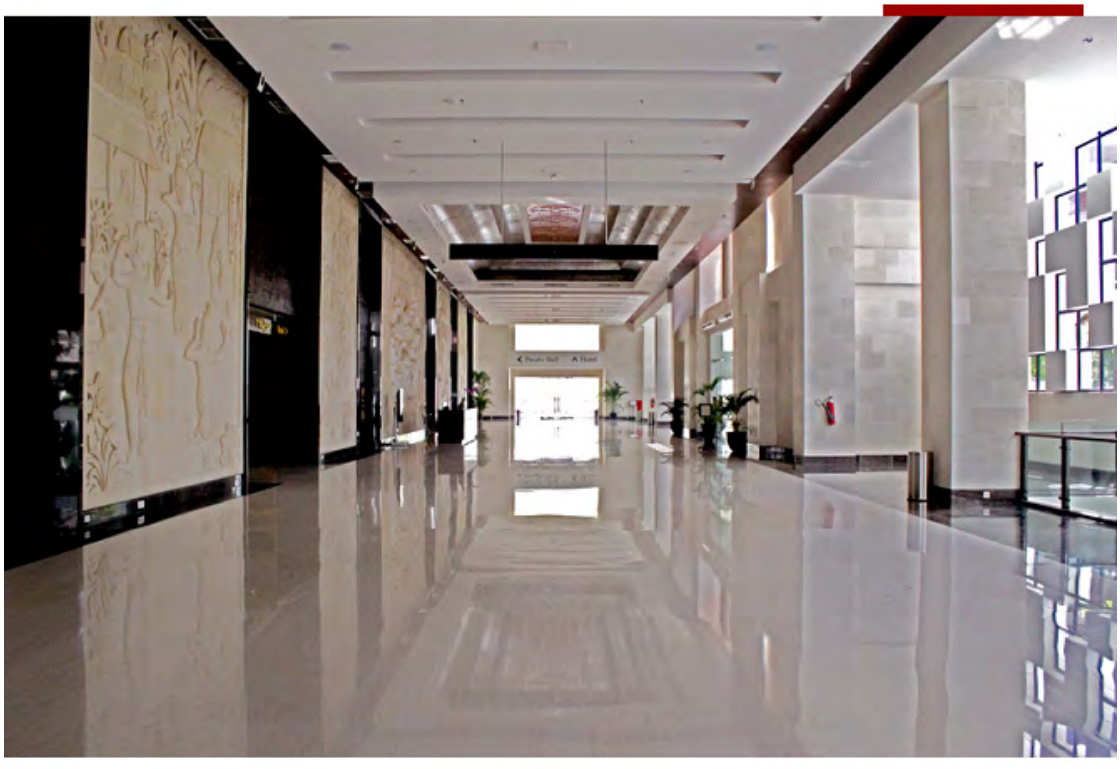
Exhibitions

The AMC 2016 exhibition will followed by Indonesian Mathematical Society (IndoMS), South East Asian Mathematical Society (SEAMS), International Mathematical Union (IMU), Korean Mathematical Society (KMS), Mathematical Society of Japan (MSJ), Wolfram*, PT. Advanced Technology Solution (Texas Instrument), EUROSpan to display of books, journals, printed materials, and other relevant products or services at its meetings and conferences. The Exhibitions of AMC 2016 will take place in the Pecatu Hall 3 and 5 Bali Nusa Dua Convention Center, Bali-Indonesia.

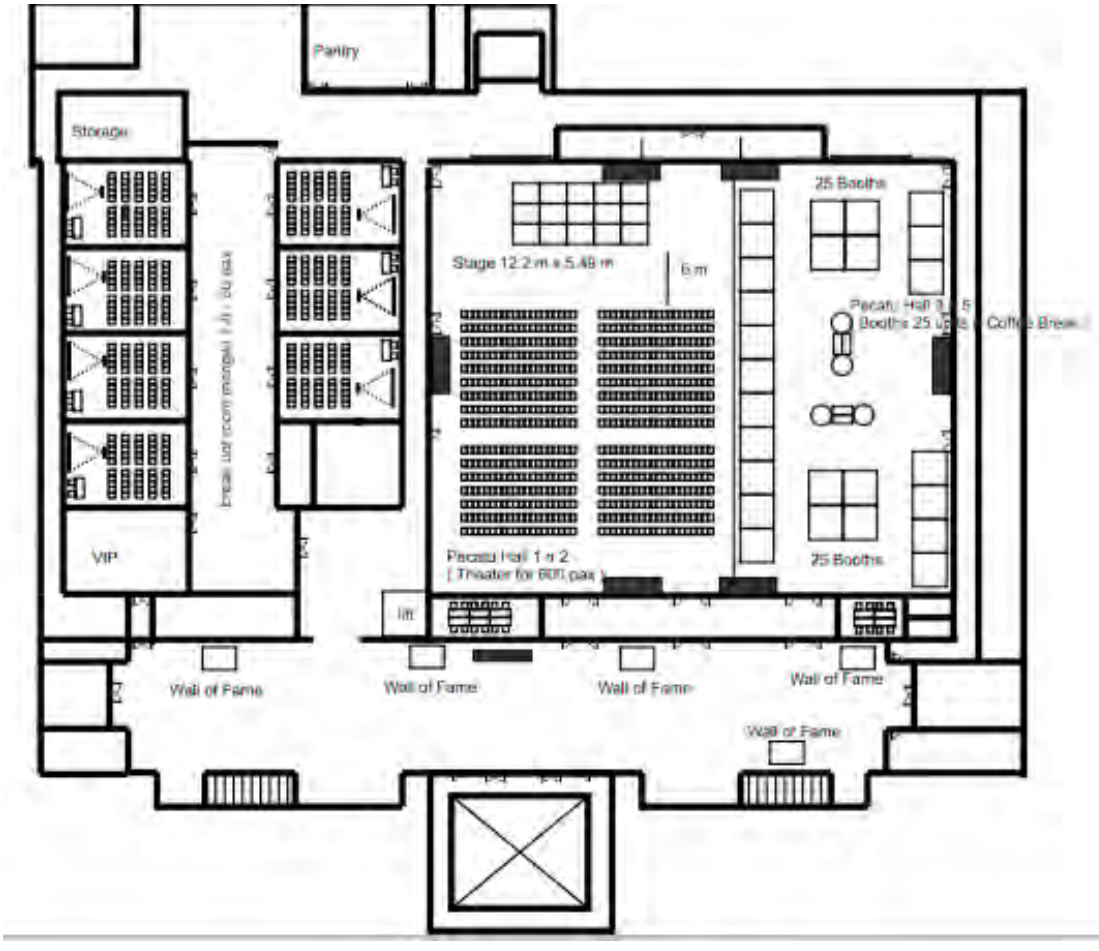
Lay out Venue at BNDCC Bali-Indonesia

Exhibitions

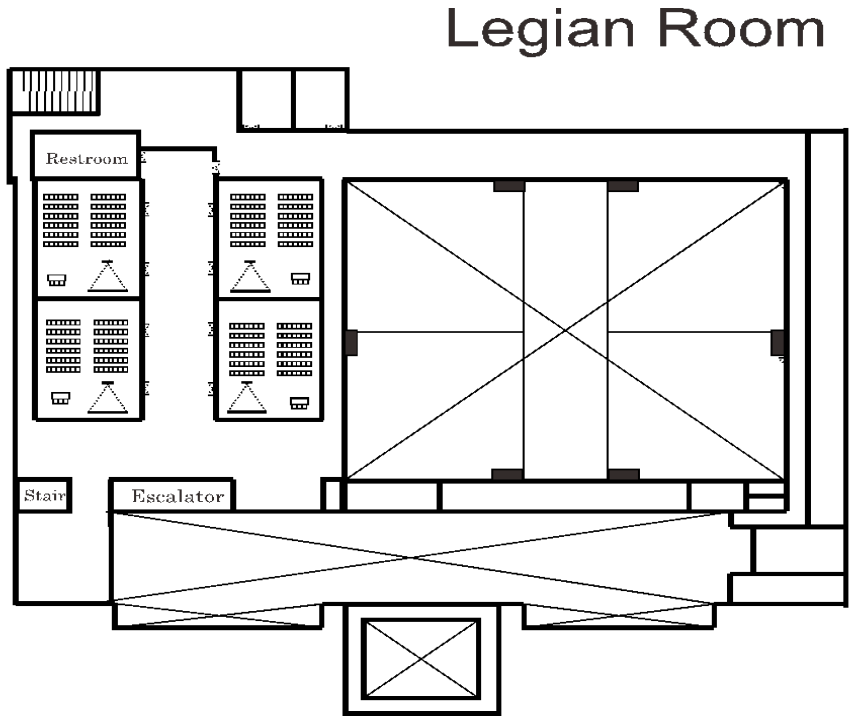
Pecatu Foyer



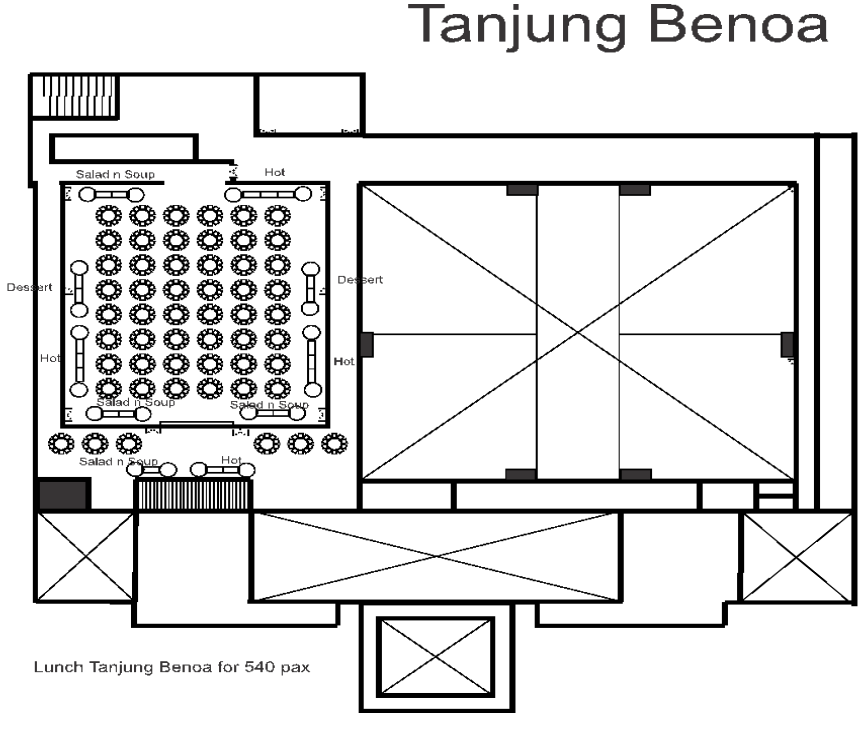
Pecatu Hall 1 & 2, Pecatu Hall 3 & 5 and Mengwi Rooms



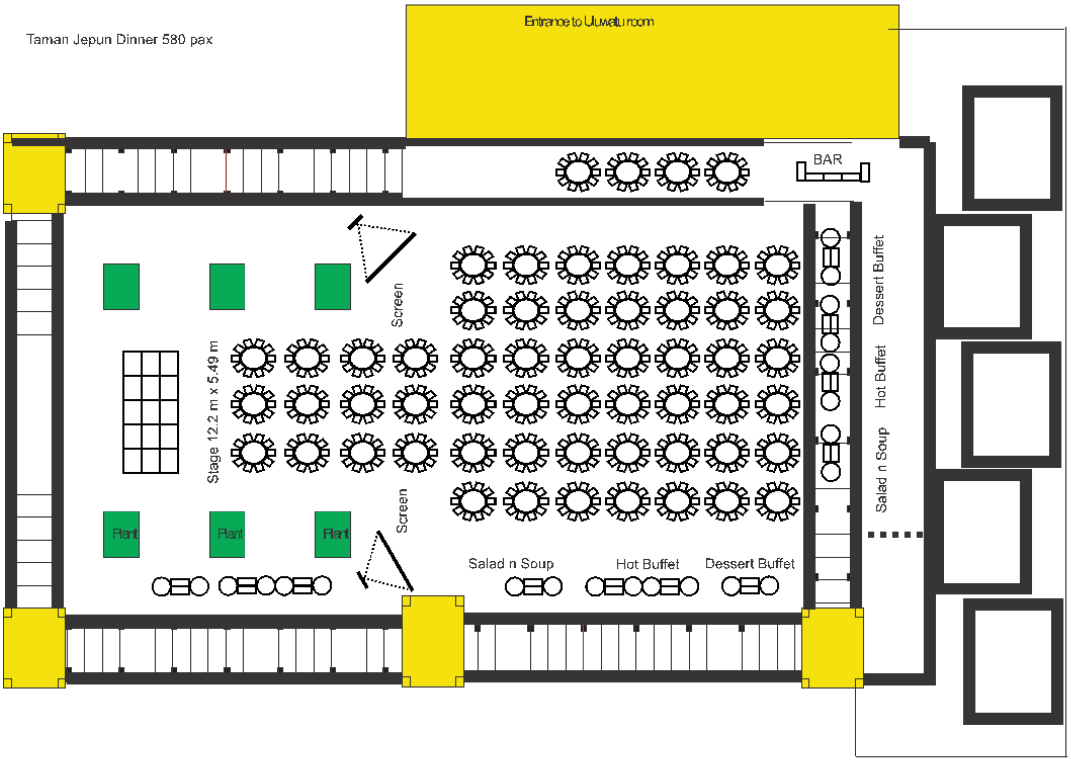
Invited and Contributed Talk at Legian Rooms

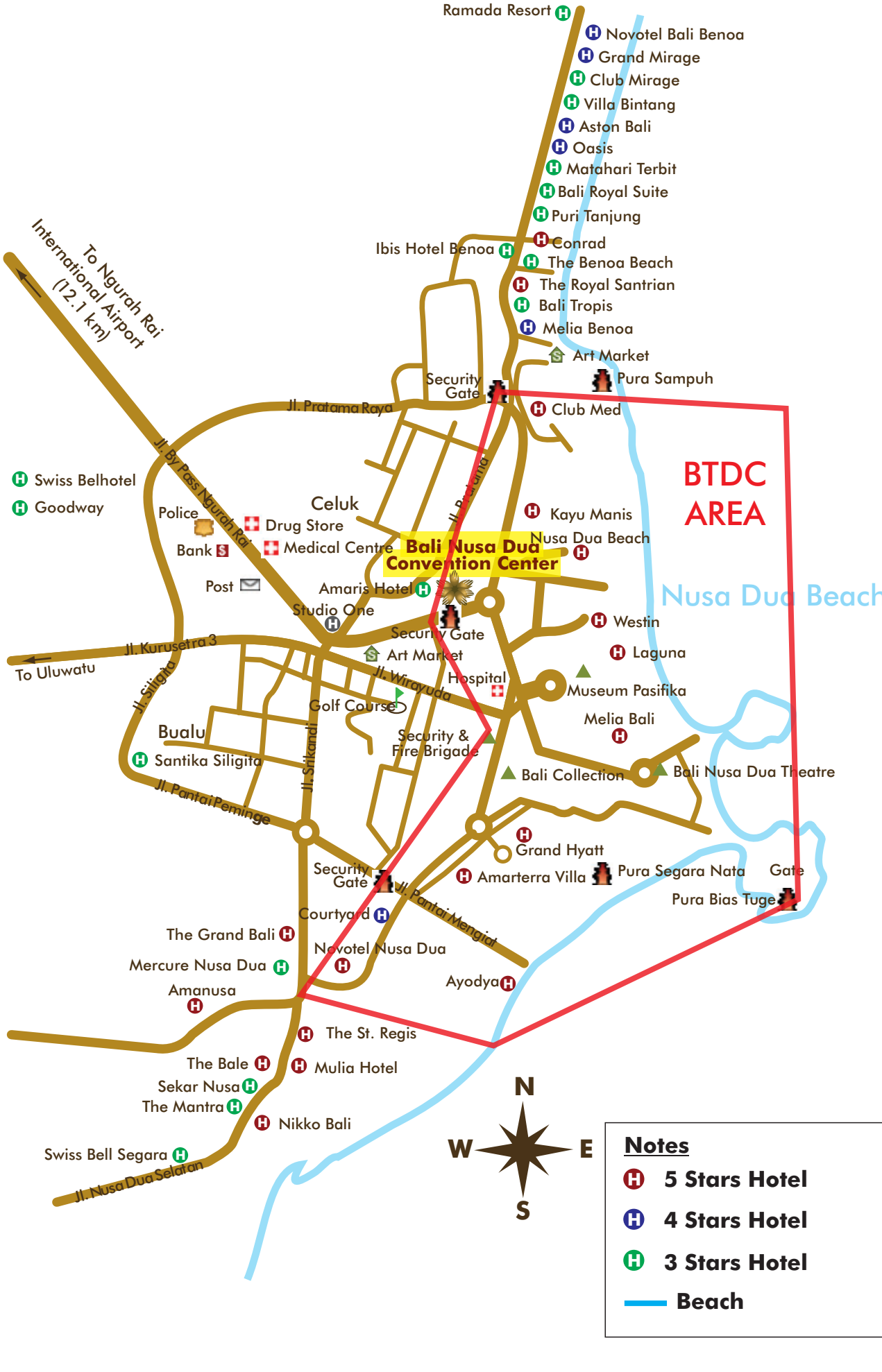


Lunch at Tanjung Benoa



Dinner at Taman Jepun




Ramada Resort
Novotel Bali Benoa
Grand Mirage
Club Mirage
Villa Bintang
Aston Bali
Oasis
Matahari Terbit
Bali Royal Suite
Puri Tanjung
Conrad
Ibis Hotel Benoa
The Benoa Beach
The Royal Santrian
Bali Tropis
Melia Benoa
Art Market
Pura Sampuh
Security Gate
Club Med
Jl. Pratama Raya
To Ngurah Rai International Airport (12.1 km)
Jl. By Pass Ngurah Rai
Swiss Belhotel
Goodway
Police
Drug Store
Bank
Medical Centre
Post
Celuk
Kayu Manis
Nusa Dua Beach
Bali Nusa Dua Convention Center
Amaris Hotel
Studio One
Security Gate
Art Market
Westin
Laguna
Museum Pasifika
Hospital
Golf Course
Melia Bali
Security & Fire Brigade
Bali Collection
Bali Nusa Dua Theatre
Jl. Kurusetra 3
To Uluwatu
Jl. Siligita
Jl. Wirayuda
Bualu
Santika Siligita
Jl. Srikandi
Jl. Pantai Peminge
Grand Hyatt
Security Gate
Amarterra Villa
Pura Segara Nata
Gate
Pura Bias Tuge
Jl. Pantai Mengiat
Courtyard
The Grand Bali
Novotel Nusa Dua
Mercure Nusa Dua
Ayodya
Amanusa
The St. Regis
The Bale
Mulia Hotel
Sekar Nusa
The Mantra
Nikko Bali
Swiss Bell Segara
Jl. Nusa Dua Selatan
BTDC AREA
Nusa Dua Beach
N
W
E
S
Notes
5 Stars Hotel
4 Stars Hotel
3 Stars Hotel
Beach

SITEMAP

Land Area : 70.000 sq.m
Gross Building : 25.000 sq.m (BNDCC 1)
16.000 sq.m (BNDCC 2)
9.000 sq.m (Hotel)

Organized by:

ITB (Institut Teknologi Bandung)
Unpad (Universitas Padjadjaran)
UGM (Universitas Gadjah Mada)
UI (Universitas Indoneisa)
UNUD (Universitas Udayana)

Supported by:

RISTEKDIKTI (Kementerian Riset Teknologi Dan Pendidikan Tinggi Republik Indonesia)
IMU (International Mathematical Union)
KMS (Korean Mathematical Society)
MSJ (The Mathematical Society of Japan)
KIAS (Korea Institute for Advanced Study)
CIMPA (Centre International de Mathématiques Pures et Appliquées)
KEMENPAR RI (Kementerian Pariwisata Republik Indonesia)
PAI (Persatuan Aktuaris Indonesia)

http://www.amc2016.org/