

Mini-Workshop
Statistics and Numerical Analysis for Stochastic Processes

VIASM, April 25th, 2019

Program

Morning section

Chair: Ngo Hoang Long

9:00 – 9:45

Mohamed Ben Alaya (Université de Rouen Normandie)

Asymptotic properties of maximum likelihood estimator for the growth rate of a stable CIR process based on continuous time observations

10:00 – 10:30

Tran Ngoc Khue (Pham Van Dong University)

LAN property for the drift parameter of ergodic diffusions with jumps from discrete observations

10:35 – 11:05

Pham Viet Hung (Hanoi Institute of Mathematics)

Persistence probability of Weyl polynomials

11:10 – 11:40

Nguyen Thanh Dieu (Vinh University)

Threshold of a stochastic SIS epidemic model with isolation

Afternoon section

Chair: Mohamed Ben Alaya

14:00 – 14:45

Ahmed Kebaier (Université Paris 13)

Non-asymptotic error bounds for The Multilevel Monte Carlo Euler method applied to SDEs with constant diffusion coefficient

15:00 – 15:20

Vu Thi Huong (University of Transport and Communications)

Multi-dimensional fractional Bessel type processes and its numerical approximation

15:25 – 15:45

Luong Duc Trong (Hanoi National University of Education)

Convergence, non-negativity and stability of a new tamed Euler-Maruyama scheme for stochastic differential equations with Holder continuous diffusion coefficient

15:50 – 16:20

Ngo Hoang Long (Hanoi National University of Education)

Numerical approximation for some classes of stochastic non-colliding particle systems

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Abstract

1. Mohamed Ben Alaya (Université de Rouen Normandie)

-Title: Asymptotic properties of maximum likelihood estimator for the growth rate of a stable CIR process based on continuous time observations.

-Abstract:

We consider a stable Cox--Ingersoll--Ross process driven by a standard Wiener process and a spectrally positive strictly stable Lévy process, and we study asymptotic properties of the maximum likelihood estimator (MLE) for its growth rate based on continuous time observations. We distinguish three cases: subcritical, critical and supercritical. In all cases we prove strong consistency of the MLE in question, in the subcritical case asymptotic normality, and in the supercritical case asymptotic mixed normality are shown as well. In the critical case the description of the asymptotic behavior of the MLE in question remains open.

2. Ngoc Khue Tran (Pham Van Dong University)

- Title: LAN property for the drift parameter of ergodic diffusions with jumps from discrete observations

- Abstract:

We consider a multidimensional diffusion with jumps driven by a Brownian motion and a Poisson random measure associated with a Lévy process without Gaussian component, whose drift coefficient depends on a multidimensional unknown parameter. In continuity with the recent work by Kohatsu-Higa et *al.* [4] where only the case of finite jump activity is studied, in this paper the case of infinite jump activity is next investigated. We prove the local asymptotic normality property from high-frequency discrete observations with increasing observation window by assuming some hypotheses on the coefficients of the equation, the ergodicity of the solution and the integrability of the Lévy measure. To obtain the result, our approach is essentially based on Malliavin calculus techniques initiated by Gobet [2, 3] and a subtle analysis on the jump structure of the Lévy process developed recently by Ben Alaya et *al.* [1].

- [1] Ben Alaya, M., Kebaier, A., Pap, G. and Tran, N.K. (2019), Local asymptotic properties for the growth rate of a jump-type CIR process, Preprint.
- [2] Gobet, E. (2001), Local asymptotic mixed normality property for elliptic diffusions: a Malliavin calculus approach, *Bernoulli*, **7**, 899-912.
- [3] Gobet, E. (2002), LAN property for ergodic diffusions with discrete observations, *Ann. I. H. Poincaré*, **38**, 711-737.
- [4] Kohatsu-Higa, A., Nualart, E. and Tran, N.K. (2017), LAN property for an ergodic diffusion with jumps, *Statistics: A Journal of Theoretical and Applied Statistics*, **51**(2), 419-454.

3. Pham Viet Hung (Hanoi Institute of Mathematics)

- Title: Persistence probability of Weyl polynomials
- Abstract:

The persistence probability of a random process is defined as the probability that the process stays positive in a long interval. In this talk, we present the new results on the logarithmic scale behavior of a special process so called random Weyl polynomials.

4. Nguyen Thanh Dieu (Vinh University)

- Title: Threshold of a stochastic SIS epidemic model with isolation
- Abstract:

This talk gives a threshold value to use to classify stochastic SIS epidemic model with isolation. It gives sufficient conditions that are very close to the necessary conditions for the strongly stochastically permanence by using a threshold value \hat{R} . Particularly, we show that if $\hat{R} < 1$ then the disease is free in sense $I(t)$ converges to 0 at the exponential rate and the density of susceptible class $S(t)$ converges to the solution of boundary equation almost surely at the exponential rate. In the case $\hat{R} > 1$, the model is strongly stochastically permanent. We also provide a unique invariant probability measure and prove the convergence in total variation norm of transition probability to the invariant measures. This is a joint work with Nguyen Huu Du (University of Science-VNU).

5. Ahmed Kebaier (Université Paris 13)

- Title: Non-asymptotic error bounds for The Multilevel Monte Carlo Euler method applied to SDEs with constant diffusion coefficient

- Abstract:

In this work, we are interested in deriving non-asymptotic error bounds for the multilevel Monte Carlo method. As a first step, we deal with the explicit Euler discretization of stochastic differential equations with a constant diffusion coefficient. We prove that, as long as the deviation is below an explicit threshold, a Gaussian-type concentration inequality optimal in terms of the variance holds for the multilevel estimator. To do so, we use the Clark-Ocone representation formula and derive bounds for the moment generating functions of the squared difference between a crude Euler scheme and a finer one and of the squared difference of their Malliavin derivatives.

6. Vu Thu Huong (University of Transport and Communications, Hanoi)

- Title: Multi-dimensional fractional Bessel type processes and its numerical approximation

- Abstract:

We consider a multi-dimensional version of fractional Bessel processes given by a fractional stochastic differential equation with irregular drift coefficient.

We prove that the equation has a unique positive solution. We propose an Euler approximation scheme for the equation, show that it is also positive, and study its rate of convergence in path-wise sense. This is a joint work with Ngo Hoang Long.

7. Luong Duc Trong (Hanoi National University of Education)

- Title: Convergence, non-negativity and stability of a new tamed Euler-Maruyama scheme for stochastic differential equations with Holder continuous diffusion coefficient.

- Abstract:

We propose and analyze a new tamed Euler-Maruyama approximation scheme for stochastic differential equations with Holder continuous diffusion. This new scheme preserves the stability and non-negativity of the exact solution. This is a joint work with Kieu Trung Thuy, Ngo Hoang Long and Nguyen Thu Thuy.

8. Ngo Hoang Long (Hanoi National University of Education)

- Title: Numerical approximation for some classes of stochastic non-colliding particle systems

- Abstract:

We present a semi-implicit Euler-Maruyama approximation scheme for some classes of stochastic non-colliding particle systems such as the Dyson-Brownian motion. We study its rates of convergence in the strong sense and show that the scheme preserves some geometric properties of the systems. This talk is based on some joint works with Dai Taguchi (Osaka University) and Luong Duc Trong (Hanoi National University of Education).