Forum 4 (November 2, Wed)

9:00-9:30

Amine Lkabous (University of Southampton)

Title: Bridging the First and Last Passage Times for LÍvy Models

Abstract: Historically, research in ruin theory has largely focused on the analysis of the first passage time of a surplus process below a threshold level (namely, the so-called time of ruin). More recently, there has been an accrued interest in the analysis of the last passage time below level 0, mainly in the framework of spectrally negative LÍvy processes (SNLPs). In an effort to bridge the first and the last passage timesÄanalyses, as well as provide a unified framework for theoretical studies, we introduce two types of random times, namely r s and r l, where the parameter r can be interpreted as a measure of a decision makerÄ aversion to negative surplus. The two random times can not only recover the first and last passage times as limiting cases, but also capture more pathwise information of the underlying surplus process. For the class of spectrally negative LÍvy processes, the Laplace transform of these two random times is explicitly derived in terms of the well-used scale functions. Concurrently, a few new results in fluctuation theory of spectrally negative LÍvy processes are obtained.

9:45-10:15

Kazutoshi Yamazaki (University of Queensland)

Title: Levy bandits under Poissonian decision times

Abstract: We consider a version of the multi-armed bandit problem driven by Levy processes (Kaspi and Mandelbaum, 1995) under the assumption that decision times are given by Poisson arrival times. We obtain the corresponding Gittins index for this problem and discuss its relation to that in the classical case.

10:30-11:00

Jose Luis Perez (CIMAT)

Title: The $\ Lambda$-asymmetric ancestral graph

Abstract: In this talk, we intend to explain the meaning of having a selective disadvantage in the general context of populations with skewed reproduction mechanisms. For instance, if the reproduction events of type 1 individuals typically are less common or have a smaller size compared to the reproduction events involving type 2 individuals. To this end, we consider a pair of populations such that the ancestry of population $i\ in\ {1,2\ }$ lies in the universality class of a $\ Lambda_i$ coalescent. Our approach consists in constructing a Moran model in which individuals of the two different populations compete, which allows us to define a

frequency process of one of the types in the population. The frequency process converges to the solution an SDE, which typically is a process with discontinuous paths. We show that we can introduce a partial order in $\mathcal{M}[0,1]$ such that if two reproduction mechanisms satisfy $\Lambda_1<\Lambda_2$ then the population of type 2 individuals will have a selective advantage. This result is the consequence of a pathwise duality result that extends the well-known duality for Λ-coalescents with classic selection, which relies on the construction of the Λ-ancestral selection graph, to Λ-coalescents associated with skewed reproduction mechanisms.

11:15-11:45

Xiaowen Zhou (Concordia University)

Title: Continuous-state Nonlinear Branching Processes

Abstract: Continuous-state branching processes can be treated as continuous-state counterparts of the Bienaym\ 'e-Galton-Watson processes. We consider a class of continuous-state branching processes with branching rates depending on the current population sizes. They are nonnegative-valued Markov processes that can be obtained either from spectrally positive L\ 'evy processes via Lamperti type time changes or as solutions to SDEs driven by Brownian motion and (or) Poisson random measure with positive jumps. The nonlinear branching mechanism allows the processes to have exotic behaviours such as coming down from infinity. But at the same time it brings new challenges to their study for lack of the branching property.

In this talk we are going to introduce the continuous-state nonlinear branching processes and recent results on coming down from infinity, explosion and extinguishing behaviours for such processes. It is based on joint work with Clement Foucart, Bo Li, Junping Li, Pei-Sen Li and Yingchun Tang.

12:00-12:30

Mitsuki Kobayashi (Waseda University)

Title: Threshold estimation for jump-diffusions under small noise asymptotics

Abstract: We consider parameter estimation of stochastic differential equations driven by a Wiener process and a compound Poisson process as small noises. The goal is to give a threshold-type quasilikelihood estimator and show its consistency and asymptotic normality under new asymptotics. One of the novelties of the paper is that we give a new localization argument, which enables us to avoid truncation in the contrast function that has been used in earlier works and to deal with a wider class of jumps in threshold estimation than ever before.

15:00-15:30

Kevin Lu (University of Washington)

Title: Parameter Estimation and Pairs Trading for Some LÍvy-driven Ornstein-Uhlenbeck Processes

Abstract: We discuss parameter estimation using maximum likelihood and Fourier inversion for LÍvy-driven Ornstein-Uhlenbeck processes, where the stationary distribution or background driving LÍvy process is a weak variance alpha-gamma distribution, a multivariate generalization of the variance gamma distribution. These processes allow for the modeling of possibly infinite activity mean reverting price processes with jumps, and we then study how to perform pairs trading in this framework in the univariate case. Specifically, we use simulation methods to demonstrate how to find the optimal level of the process to enter and exit trades, with control variate as a variance reduction technique.

15:45-16:15

Dai Taguchi (Okayama University)

Title: Approximation for LÍvy driven SDEs with irregular coefficient

Abstract: Recently, a numerical approximation for LÍvy driven SDEs with irregular coefficients have been widely studied. In this talk, we consider the Euler--Maruyama scheme for SDE $dX(t)=\sigma(X(t)) dZ(t)$ driven by a symmetric α stable process with irregular coefficient σ. We will provide a strong rate of convergence. The idea of the proof is to use a version of Avikainen's inequality.

16:30-17:00

Xiang Yu (Hong Kong Polytechnic University)

Title: Mean Field Game of Optimal Relative Investment with Jump Risk

Abstract: This paper studies the n-player game and the mean field game under the CRRA relative performance on terminal wealth, in which the interaction occurs by peer competition. In the model with n agents, the price dynamics of underlying risky assets depend on a common noise and contagious jump risk modelled by a multi-dimensional Hawkes process. With a continuum of agents, we formulate the MFG problem and characterize a deterministic mean field equilibrium in an analytical form under some conditions, allowing us to investigate some impacts of model parameters in the limiting model and discuss some financial implications. Moreover, based on the mean field equilibrium, we can construct an approximate Nash equilibrium for the n-player game when n is sufficiently large. The explicit order of the approximation error is also derived.

17:15-17:45

Phillip Yam (Chinese University of Hong Kong)

Title: Universal Poisson Approximations for Wiener Functionals Arisen in Finance

Abstract: It is a well-known simple fact that the limit of a compensated Poisson process, as the intensity goes to infinity, is a Brownian motion, but does the same result hold for general Wiener functionals? In this talk, we propose a global, chaos-based procedure for the discretization of Wiener functionals of Brownian motion into one of a Poisson process with intensity $\lambda > 0$. Under this discretization, we study the weak convergence, as the intensity of the underlying Poisson process goes to infinity, of Poisson functionals and their corresponding Malliavin-type derivatives to their Wiener counterparts. More specifically, we derive a convergence rate of $O(\lambda^{(-1/4)})$ for the Poisson discretization of Wiener functionals by combining the multivariate Chen-Stein method with both the Poisson and Wiener calculi. At the first glance, the proposed sufficient condition for establishing this convergence rate requires the knowledge of the kernel functions in the Wiener chaos, which apparently limits its potential use as most of the Wiener functionals are so general that it is hard to find their kernels explicitly, let alone to verify this mild sufficient condition. Nevertheless, most of the Wiener functionals in finance should be a classical function of certain non-linear SDE solutions, and one of our main results is to get around the above complications; specifically, we can still establish the convergence of Poisson discretizations of solutions to a broad class of nonlinear SDEs with respect to Brownian motion. Moreover, numerical experiments also support the optimality of the convergence rate of 1/4; besides, the discretized Malliavin operators can be further applied to approximate the Greeks in option pricing framework. To the best of our knowledge, these are the first results in the literature on the universal convergence rate of a global discretization of a generally useful class of Wiener functionals.

18:00-18:30

Oscar Gutierrez (Universite de Lausanne)

Title: Time-homogeneous approximations of time-inhomogeneous Markov jump processes and applications

Abstract: The study of time-inhomogeneous Markov jump processes is a traditional topic within probability theory that has recently attracted substantial attention in various applications. However, their flexibility also incurs a substantial mathematical burden which is usually circumvented by using well-known generic distributional approximations or simulations. In this talk we provide a novel approximation method that tailors the dynamics of a conditional time-homogeneous Markov jump process to meet those of its time-inhomogeneous counterpart on an increasingly fine Poisson grid. Special attention is devoted

to the case where the target process has one absorbing state and the remaining ones transient, for which the absorption times also converge. We finalize by providing a few applications of our approximation method in applied probability.