6th Ritsumeikan-Monash Symposium on Probability and Related Fields

Date November 11(Fri.)-13(Sun.), 2016

Place 11(Fri.) & 12(Sat.) Colloquium Room, West Wing 6F, Biwako-Kusatsu Campus, Ritsumeikan University, Kusatsu

13(Sun.) Room 3402, 3rd Buld., 4th school area, Kansai University, Osaka

Speakers: Pavel Chigansky (Hebrew Univeristy), Andrea Collevecchio (Monash University), Corina Constantinescu (University of Liverpool), Freddy Delbaen (University of Zurich), Jie Yen Fan (Monash University), Masaaki Fukasawa (Osaka University), Tim Garoni (Monash University), Kais Hamza (Monash University), Honda Naoki(Kyoto Univeristy), Yuri Imamura (Tokyo University of Science), Fima Klebaner (Monash University), Marie Kratz (ESSEC), Greg Markowsky (Monash University), Leonardo Rojas Nandayapa (University of Liverpool), Martin Russel-Keller (TU Dresden), Vladimira Seckarova (Czech Academy of Sciences).

Program

November 11 (Friday)

13:30-14:00(Talk), 14:00-14:15(Discussion) Andrea Collevecchio (Monash University)
Once reinforced biased random walks

14:30-15:00(Talk), 15:00-15:15(Disucussion) Leonardo Rojas Nandayapa (University of Liverpool)
Approximation of heavy-tailed distributions via infinite dimensional phase-type distributions with an application in risk

15:15-15:45 Student Session & Tea Break

15:45-16:15(Talk), 16:15-16:30(Discussion) Vladimira Seckarova (Czech Academy of Sciences)
Information-theoretic approach to combining expert opinions in probabilistic form

16:45-17:45(Talk), 17:45-18:00 (Discussion) Greg Markowsky (Monash University)
Reflection, homotopy, and the distribution of planar Brownian motion at stopping times

18:00- Welcome Party

November 12 (Saturday)

10:00-10:30(Talk), 10:30-10:45(Discussion) Marie Kratz (ESSEC)
CLT for Lipschitz-Killing curvatures of excursion sets of Gaussian random fields

10:50-11:20(Talk), 11:20-11:35(Discussion) Corina Constantinescu (University of Liverpool)
Risk models with dependence

11:40-12:10(Talk), 12:10-12:25(Discussion) Tim Garoni (Monash University)
Critical speeding-up in percolation

12:25-14:00 Lunch Break

14:00-14:30(Talk), 14:30-14:45(Discussion) Honda Naoki (Graduate School of Medicine, Kyoto University)
Mathematical modeling in stem cell dynamics

Masanori Koyama (Ritsumeikan University)
Model identification with distributional dataset and efforts toward the regulation of biological system

15:35-16:00 Tea Break

16:00-16:30(Talk), 16:30-16:45(Discussion) Fima Klebaner (Monash University)
Fluid limits with random initial conditions

16:50-17:20(Talk), 17:20-17:35(Discussion) Jie Yen Fan (Monash University)
Measure-valued population processes and their asymptotics

18:30- Dinner at Jyu-Zen no Sato

November 13 (Sunday)

10:30-11:10 Kais Hamza (Monash University)
Alternative models in finance

11:30-12:10 Pavel Chigansky (Hebrew Univeristy)
Steady state accuracy in linear filtering

12:10-14:00 Lunch Break

14:00-14:40 Martin Russel-Keller (TU Dresden)
Affine processes with stochastic discontinuities

14:50-15:30 Yuri Imamura (Tokyo University of Science)
The Value of Timing Risk

15:40-16:20 Masaaki Fukasawa (Osaka University)
Rough volatility and related topics

16:40-17:20 Freddy Delbaen (University of Zurich)
Risk measures on Orlicz spaces: some new characterisation of convex closed sets

17:30- Closing

Abstracts

Pavel Chigansky (Hebrew Univeristy)

Title: Steady state accuracy in linear filtering

Abstract:Filtering of signals from the background noise is a fundamental problem in engineering. Besides constructing computationally efficient filtering algorithms for a given model, it is also important to assess the best achievable accuracy. In this talk I will revisit the questions of existence and computation of the steady state estimation error of the optimal continuous time linear filters, beyond the well understood Gauss-Markov framework (joint work with Marina Kleptsyna).

Andrea Collevecchio (Monash University)

Title: Once reinforced biased random walks

Abstract: Consider a random walk that prefers to cross edges (or visit vertices) that it has crossed (or visited) in the past. The once-reinforced random walk is such a walk, where edges (or vertices) that have been previously visited have weight a and those that haven't have weight b¡a, and the walk chooses its next step with probability proportional to the weights at its current location. We will discuss variants of this model where the underlying random walk itself has a bias.
Joint work with Mark Holmes and Daniel Kious.

Corina Constantinescu (University of Liverpool)

Title: Risk models with dependence

Abstract:We will speak of some dependence structures used in modeling collective insurance risks. Discussions: Possible extensions.

Freddy Delbaen (ETH-Zurich, Uni-Zurich, on visit at Tokyo Metropolitan University)

Title: Risk measures on Orlicz spaces: some new characterisation of convex closed sets

Abstract: The usual denition for monetary utility functions is given on the space L^∞. For dual spaces, L^Φ, of Orlicz $-\Delta_2$ spaces, L^Ψ, there are two generalisations. One uses norm bounded sets, the other one uses order intervals. We show that a monetary utility function has a dual representation with a penalty function dened on L^Φ, if the utility function is upper semi continuous for the convergence in probability on order intervals. More precisely we show that a convex set $C \subset L^\Phi$ is $\sigma(L^\Phi, L^\Psi)$ closed if for each order interval, $[-\eta, \eta] = \{\xi |\ -\eta \leq \xi \leq \eta\}$ $(0 \leq \eta \in L^\phi)$, the intersection $C \cap [-\eta, \eta]$ is closed for the convergence in probability. The result is based on the following technical lemma. For a norm bounded sequence ξ_n in L^Φ, which converges in probability to 0, there exist *forward* convex combinations $\zeta_n \in conv\{\xi_n, \xi_{n+1}, \ldots\}$ as well as an element $\eta \in L^\Phi$, such that $\zeta_n \to 0$, almost surely and $|\zeta_n| \leq \eta$.

Jie Yen Fan (Monash University)

Title: Measure-valued population processes and their asymptotics

Abstract: Population process in general setting, where each individual reproduces and dies depending on the state (such as age and type) of the individual as well as the entire population, offers a more realistic framework to population modelling. Formulating the population process as a measure-valued stochastic process allows us to incorporate such dependence. We consider a family of such age-and-type-structure dependent population processes indexed by some parameter K, which may represent the carrying capacity, and give its asymptotic behaviour as K increases, namely the law of large numbers and the central limit theorem.
Joint work with Kais Hamza, Peter Jagers and Fima Klebaner.

Masaaki Fukasawa (Osaka University)

Title: Rough volatility and related topics

Abstract: The rough volatility model has recently attracted much attention due to its consistency to stylized facts of both historical and implied volatility data. The volatility of an asset is driven by a fractional Brownian motion which is correlated to a Brownian motion driving the asset. By rough we mean that the Hurst parameter is less than half. In this talk, we discuss several recent advances (most of which are ongoing works) including an asymptotic analysis of implied volatilities, an asymptotic analysis for normalized return distributions, a high-frequency data analysis for fractional Gaussian noises and some empirical evidences.

Tim Garoni (Monash University)

Title: Critical speeding-up in percolation

Abstract: We prove the existence of critical speeding-up for the mean cluster size in two and high-dimensional percolation. More precisely, we prove that the dynamical critical exponent of the corresponding integrated autocorrelation time is negative for bond percolation on high dimensional tori and on the triangular lattice. The proof of the latter harnesses recent rigorous results on the conformal invariance of critical site percolation on the triangular lattice.
Joint work with Andrea Collevecchio, Eren Elci and Greg Markowsky.

Kais Hamza (Monash University)

Title: Alternative models in finance

Abstract: The Black-Scholes formula has been derived under the assumption of constant volatility in stocks. In spite of evidence that this parameter is not constant, this formula is widely used by the markets. It is therefore natural to ask whether a model for stock price exists such that the Black-Scholes formula holds while the volatility is non-constant.

In this talk I will review a number of results on the existence of alternative models in option pricing and beyond.
Joint work with Fima Klebaner, Olivia Mah and Jie Yen Fan.

Honda Naoki(Graduate School of Medicine, Kyoto University)

Title: Mathematical modeling in stem cell dynamics

Abstract:Many sperm stem cells in testis daily produce a numerous number of sperms. However, how each stem cell contributes to sperm population has been completely unknown. To examine this question, we performed experiment in which male mice always mate with females and produce offspring. We then obtained intriguing observations that offspring deriving from the same stem cell clones were often born at a time, and the same stem cell clones re-appear later with a specific time windows. These observations were inconsistent with classical view that the sperm stem cells equally and constantly produce sperms. To reproduce the observed data, we mathematically modeled sperm production activity of the stem cells by combination of inhomogeneous Poisson process and gamma process. Through the model parameter estimation, we clarified that sperm stem cells alternatively repeat activation and resting periods.

Yuri Imamura (Tokyo University of Science)

Title: The value of timing risk

Abstract: In the talk, we are interested in the risk to cover (some portion of) the price of the option at a default time. The risk, which we call timing risk, is a risk of uncertain dividend, especially of its payment time. Credit derivatives typically are exposed to the risk. We will discuss how it could be hedged by a static position of European path-independent options, generalizing P. Carr and J. Picron (1999) where they applied the semi-static hedging formula of barrier options to hedge a payment at a stopping time in a Black-Scholes environment. We will give an exact hedging formula in an multi-dimensional general diffusion setting.

Fima Klebaner (Monash University)

Title: Fluid limits with random initial conditions

Abstract: We consider stochastic dynamics with a small noise. As noise goes to zero a fluid limit is obtained. We show that, under some conditions, on intervals increasing to infinity the fluid limit has random initial conditions. This phenomenon is observed in continuous as well as discrete systems and with continuous and jump noises. A model of the Polymerase Chain Reaction provides an application in Biology.
Joint work with Barbour, Chigansky, Hamza and Jagers.

Masanori Koyama (Ritsumeikan University)

Title: Model identification with distributional dataset and efforts toward the regulation of biological system

Abstract: In many real world problems, it is difficult in general to continuously track multiple objects and obtain dense samples of the time course of the statistics of the objects simultaneously. The datasets that are more readily available is the sequence of the empirical distributions(snapshots) of the system sampled at sparse time points. One encounters this type of dataset especially often in Biological experiments. In this talk we will discuss a method to assimilate snapshot datasets to the model of interest. We will also discuss a methodology to regulate the system in real time, which is the ultimate goal of the model assimilation.

Marie Kratz (ESSEC)

Title: CLT for Lipschitz-Killing curvatures of excursion sets of Gaussian random fields

Abstract: Consider a Gaussian random field f defined on the d-dimensional Euclidean space, and define f_T as the restriction of f to a convex subset T of $\mathbb{R}^d$. We study the asymptotic behavior of some global geometric functionals called the Lipschitz-Killing curvatures of the excursion sets $A_u(f_T)$ of f_T above the threshold u. In particular, we show, after appropriate normalization, that, as the parameter space of the random field increases to the full Euclidean space, the Lipschitz-Killing curvatures of $A_u(f_T)$ converge weakly to a Gaussian random variable, thus exhibiting a central limit theorem for the geometric functionals.
Joint work with Sreekar Vadlamani (TIFR-CAM, Bangalore, India).

Greg Markowsky (Monash University)

Title: Reflection, homotopy, and the distribution of planar Brownian motion at stopping times

Abstract: It is well known that harmonic measure in two dimensions can be interpreted in terms of exit distributions of Brownian motion, and therefore the conformal invariance of planar Brownian motion implies the conformal invariance of harmonic measure. I will explain how this conformal invariance can be extended to analytic functions which are not necessarily conformal, and to stopping times which are not necessarily exit times. This will allow considerations of homotopy and reflection to be applied in order to compute exit distributions of various domains, as well as the distribution of Brownian motion at certain other stopping times. A side effect of these methods is the derivation of a number of infinite sum identities, such as Euler's Basel sum and the Leibniz formula for π.

Leonardo Rojas Nandayapa (University of Liverpool)

Title: Approximation of heavy-tailed distributions via infinite dimensional phase-type distributions with an application in risk

Abstract: Phasetype distributions are inherently light-tailed and cannot capture the characteristic features of heavy-tailed phenomena—a notorious example is the probability of ruin in classical risk models. Recently, Bladt, Nielsen and Samorodnitsky suggested a class of infinite mixtures of phasetype distributions. Such an extended class inherits the

mathematical tractability and dense property of phase-type distributions but in contrast these can be heavy-tailed.

We investigate the tail properties of such a class of distributions and suggest a simple yet systematic methodology for constructing approximations within this class for any heavy-tailed distribution. Our approach is simple but provides an excellent adjustment in the tails. Using the of Bladt, Nielsen and Samorodnitsky together with these new results we further refine a methodology to approximate ruin probabilities for the classical Cramér–Lundberg model. We complement our results with estimation procedures and bounds for the error of approximation.

Martin Russel-Keller (TU Dresden)

Title: Affine processes with stochastic discontinuities

Abstract: Motivated by applications in finance, such as credit risk, we study affine processes without the common assumption of stochastic continuity. Such processes are semimartingales, but usually not quasi-left-continuous and may exhibit jumps at predetermined times. We derive the associated Riccati equations that determine the characteristic function of the process and discuss some results on existence.

This is joint work with Thorsten Schmidt and Robert Wardenga.

Vladimira Seckarova (Czech Academy of Sciences)

Title: Information-theoretic approach to combining expert opinions in probabilistic form

Abstract: The aggregation of experts' opinions, expressed as probabilities assigned to possible events, is of great importance in many branches of decision making, economics, social sciences. We propose a systematic way how to combine discrete probability distributions based on the Bayesian decision making theory and theory of information, namely the cross-entropy (also known as the Kullback-Leibler (KL) divergence). The optimal combination is a probability mass function minimizing the conditional expected KL-divergence. The expectation is taken with respect to a probability density function (pdf) also minimizing the KL-divergence under problem-reflecting constraints. For the Dirichlet distribution being this pdf the resulting combination is linear with weights related to above mentioned constraints. We next compare this combination with other KL-divergence based combinations linear (lin) and logarithmic (log) with equal weights. When an event assigned higher probability occurs, proposed combination performs similarly to the lin combination and outperforms log combination. When low probability event occurs, proposed combination outperforms both, lin and log combination. Thus, proposed combination improves decision making in areas such as crowd modelling (pedestrian movement) and betting (predictions for football games results).