UNIVERSITY OF
LIVERPOOL

Institute for Financial and Actuarial Mathematics (IFAM)

Joint International Research Open

J.I.R.O. – March 1, 2016, Liverpool

RARE workshop in Stochastic Analysis and Applications

As part of the RARE EU-IRSES 318984 project, we are happy to host a one day workshop at the University of Liverpool. PhD, MSc and UG students are welcome to attend. Coffees and lunch is provided for the invited speakers and IFAM academics.

Program of the day

9:00-9:30 Welcome - Coffee at VGM

Morning Session (Seminar room 521, Cedar House, 360 on the map)

9:30 -10:15 Andrea Macrina (UCL, London)
Rational Multi-Curve Models with Counterparty-Risk Valuation Adjustments
10:15 - 10:45 Camilo Garcia Trillos (UCL, London)
Estimation of Future Initial Margins in a Multi-Curve Interest Rate Framework
10:45-11:15 Coffee at VGM

11:15 – 12:00 Mihalis Zervos (LSE, London)
Dynamic contracting under moral hazard
12:00 – 12:30 Yuri Imamura (Ritsumeikan University, Japan)
Symmetrization of Diffusion Processes
12:30- 14:00 Lunch at VGM

Afternoon Session (Lecture room 203 (E3) Electrical Engineering, 235 on the map)

14:00 - 14:45 Kai Liu (UoL, Liverpool)
Stabilization of Retarded Stochastic Linear Differential Equations by noise
14:45 – 15:15 Zhongyang Sun (Nankai University, China)
General stochastic maximum principle for processes driven by G-Brownian motion
15:15-15:45 Coffee at VGM

15:45 – 16:30 Toshihiro Yamada (Tokyo Universiry, Japan)
A weak approximation of SDEs: application to computational finance
16:30- 17:00 Alexey Piunovskiy (UoL, Liverpool)
Control process in continuous-time MDP and its properties

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Titles and abstracts (alphabetical order by the speaker's name)

1. **Camilo Garcia Trillos (UCL, London)**

Title: Estimation of Future Initial Margins in a Multi-Curve Interest Rate Framework

Abstract: We propose an approach for the dynamical estimation of initial margins. We determine initial margins at future points in time by computing a risk measure of the modelled price increment over a margin period of risk. As an example, we produce the initial margin process for interest rate swap clearing where we assume that the swap price process is driven by a two-factor multi-curve interest rate model that exhibits good calibration properties. The obtained initial margin dynamics incorporate "forward-looking" information present in swaptions market data to which the swap price model is calibrated. We compare the model-generated initial margin process to initial margin data provided by clearing houses and propose adjustments to reduce the observed gap. In doing so, we in effect calibrate the initial margin process to additional market information possibly present in historical market data but not captured in the swaptions market. The margin valuation adjustment (MVA) process is obtained by an application of the risk-neutral valuation formula where the initial margin process is taken as the underlying instrument. We conclude with answers to questions we have received from the financial industry.
http://ssrn.com/abstract=2682727

2. **Yuri Imamura (Ritsumeikan U, Japan)**

Title: Symmetrization of Diffusion Processes

Abstract: In the talk, we discuss how a risk associated with a stopping time, which we call a generalized timing risk, could be hedged by a static position of European path-independent options. Timing risk is a risk of uncertain dividend, especially of its payment time. P. Carr and J. Picron (1999) tried to apply the semi-static hedging formula of barrier options to hedge a payment at a stopping time in a Black-Scholes environment. In this study, we show that an asymptotic static edge of a generalized timing risk in a general diffusion model is possible, and then we give an error estimate of the asymptotic static hedge of a generalized timing risk.

3. **Kai Liu (UoL, Liverpool)**

Title: Stabilization of Retarded Stochastic Linear Differential Equations by noise

Abstract: In this talk, some sufficient conditions for stochastic stability in both p-th moment and almost sure sense are established. Given an unstable functional differential equation, we may perturb it into a stable stochastic functional differential equation driven by Gaussian noise. A class of examples of stochastic partial differential equations with time delays are presented to illustrate our theory.

4. Andrea Macrina (UCL, London)

Title: Rational Multi-Curve Models with Counterparty-Risk Valuation Adjustments

Abstract: We develop a multi-curve term structure set-up in which the modelling ingredients are expressed by rational functionals of Markov processes. We calibrate to London Interbank Offer Rate swaptions data and show that a rational two-factor log-normal multi-curve model is sufficient to match market data with accuracy. We elucidate the relationship between the models developed and calibrated under a risk-neutral measure Q and their consistent equivalence class under the real-world probability measure P. The consistent P-pricing models are applied to compute the risk exposures which may be required to comply with regulatory obligations. In order to compute counterparty-risk valuation adjustments, such as credit valuation adjustment, we show how default intensity processes with rational form can be derived. We flesh out our study by applying the results to a basis swap contract. http://dx.doi.org/10.1080/14697688.2015.1095348

5. Alexei Piunovskiy (UoL, Liverpool)

Title: Control process in continuous-time MDP and its properties

Abstract: In the framework of standard control strategies, one can construct the control process using the Kolmogorov Consistency Theorem. But, if the strategy is not deterministic, then that process is not jointly measurable w.r.t. (w,t), the statement of the Fubini Theorem may be wrong etc. All that will be illustrated by elementary examples.

6. Zhongyang Sun (Nankai U, China)

Title: General stochastic maximum principle for processes driven by G-Brownian motion

Abstract: In this talk, based on the theory of stochastic calculus on a sublinear expectation space, we investigate the stochastic optimal control problems under G-expectation. Under standard assumptions, we establish a general maximum principle for stochastic differential equations driven by G-Brownian motion.

7. Toshihiro Yamada (Tokyo U, Japan)
Title: A weak approximation of SDEs: application to computational finance

Abstract: In this talk, we show a type of weak approximation scheme for stochastic differential equations. Moreover, we introduce a new second order method. Some numerical results for local and stochastic volatility models are shown as examples.

8. Mihalis Zervos (LSE, London)

Title: Dynamic contracting under moral hazard

Abstract: We consider a contracting problem that a firm faces in the presence of managerial moral hazard and stochastic cashflows. We first develop a general contracting setting. We then restrict attention to contracts that admit appropriate state space representations. In the latter context, we establish the link between the optimal contract and the solution to a suitable stochastic control problem.