



JSS / IELM Seminar

**Three Financial Engineering Problems:
Asian Options, Occupation Times, and Modeling of Energy Markets**

presented by

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Date : March 24, 2010 (Wednesday)

Time : 10:30 a.m.

Venue : Room 5583 < lift 29-30 >

Abstract :

The talk is concerned with three research problems in financial engineering: (i) How to price Asian options analytically within the jump diffusion framework? (ii) What is the counterpart of the arcsin law for a jump diffusion process? (iii) How to model the energy markets?

For the first problem, we derive a closed-form double-Laplace transform for the Asian option price under a hyper-exponential jump diffusion model. This is made possible primarily because we manage to obtain an analytical solution to the distribution of the integral of the underlying asset price process. In fact, in a simpler and more robust way, we extend the elegant analytical approach of Geman and Yor (1993) from the Black-Scholes model to a quite general jump diffusion model. This is joint work with S. G. Kou from Columbia University.

For the second problem, we investigate the joint distribution of the occupation time of a hyper-exponential jump diffusion process and its terminal value. The analytical result can be applied to price a variety of occupation-time-related options, including step, quantile, and hurdle options. This is joint work with Nan Chen and Xiangwei Wan from CUHK.

For the third problem, we propose a two-factor, equilibrium model for the electricity spot and futures prices. Not only can our model capture features such as spikes and seasonality, but it also has some other properties. (1) It can well explain the oligopoly. (2) It can capture the uncertainty about the length of the spikes. More precisely, our model allows for either finite or infinite expectations for the spot prices. However, the futures prices always have finite expectations. (3) It can incorporate different mean reversion structures of the spot prices. This is joint work with John R. Birge from University of Chicago and S. G. Kou from Columbia University.

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Ning Cai is currently an Assistant Professor in financial engineering in the Department of Industrial Engineering and Logistics Management at the Hong Kong University of Science and Technology. He received both M.S. and Ph.D. in operations research in the Department of Industrial Engineering and Operations Research at Columbia University in 2005 and 2008 and both B.S. and M.S. in probability and statistics in the School of Mathematical Sciences at Peking University.

Ning Cai's research interests include financial engineering and applied probability. More precisely, his research focuses on modeling of general financial markets as well as energy markets and asset pricing under jump diffusion models. In addition, his research also consists of the Laplace transform inversion algorithm. In INFORMS 2007, he won the Second Place of the Best Student Research Paper Award in Financial Services Section. In INFORMS 2008, he won the honorable mention of the George E. Nicholson Student Paper Competition.

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