

## **Finsurance MITACS project - Student Seminar Day**

Location: Fields Institute, 222 College Street, 2nd floor

Date: Tuesday April 14, 10am-1pm

A light lunch will be provided, courtesy of the IFID centre.

Part of the objectives of the MITACS finsurance project is to build a network of researchers working in this area. The student seminar day provides a venue for students working in this area, and researchers associated with the project, to learn what kind of things others are working on. All six speakers are PhD students at the University of Toronto or at York University, speaking about work in progress.

### **Schedule**

10:00-10:15 Introductions and status of the MITACS project. (Tom Salisbury)  
What are IFID and QWeMA anyway? (Moshe Milevsky)

10:15-10:35 Angelo Valov, Dept. Statistics, Univ. of Toronto.  
First Passage Time Problems with Applications to Finance and Insurance

10:40-11:00 Haohan Huang, Dept of Math & Statistics, York Univ.  
Credit Contingent Interest Rate Swap Pricing

11:05-11:25 Ling-Wu Shao, Schulich School of Business.  
Asset Allocation (portfolio choice) with fixed and variable annuities, a simplified 3-  
period example

11:30-11:50 Georg Sigloch, Ph. D. Candidate, Dept. Mathematics, Univ. Toronto  
Incorporating Risk Aversion and Model Uncertainty into Structural Models of  
Default

11:50-12:15 Lunch

12:15-12:35 Yun Qiao, Dept. of Math & Statistics, York University  
Guaranteed Minimum Withdrawal Benefits from an investor's perspective

12:40-1:00 Mirela Cara, Dept. of Math & Statistics, York University  
Probability of Lifetime Ruin in the Case of Wealth Dynamics with Jumps

## **ABSTRACTS**

Angelo Valov, Dept. Statistics, Univ. of Toronto

First Passage Time Problems with Applications to Finance and Insurance

The recent developments in quantitative finance and actuarial science have spurred renewed attention in potential applications of First Passage Time problems for diffusion and jump diffusion processes. The structural approach of modeling default of a firm as a first passage time of a Geometric Brownian motion to a fixed boundary is a particular example of such an application but such a boundary fails to match bond yields and CDS spreads. This motivates the study of the first passage times for non-linear boundaries. One of the main tools in attacking the First Passage Time problem for Brownian motion is the class of Volterra integral equations due to Peskir. In this talk we will generalize this class and construct new equations. Uniqueness of a continuous solution will be shown for a particular subclass. Furthermore, we will show how these equations lead to a partial solution of the inverse problem by randomizing the starting point of the Brownian motion. The randomization technique is particularly well suited for building a mortality model which incorporates the biological aging process of individuals. Finally we discuss properties of such dynamic mortality model with particular emphasis on the model induced risk neutral measure and the pricing of simple mortality linked financial products.

Haohan Huang, Dept of Math & Statistics, York Univ.

Credit Contingent Interest Rate Swap Pricing

At the China-Canada Quantitative Finance Workshop held in Weihai, China, Oct 6-10, 2008, Dr. Yong Wang from RBC Financial Groups presented a problem on counterparty risk pricing. We have achieved the first step with three methods. Monte Carlo method, PDE method and Binomial tree method. I will simply present with Monte Carlo method and 1-dimensional PDE method in this talk.

Georg Sigloch, Ph. D. Candidate, Dept. Mathematics, Univ. Toronto

### Incorporating Risk Aversion and Model Uncertainty into Structural Models of Default

Using indifference pricing with exponential utility, we determine corporate bond prices and CDS spreads. Leung, Sircar and Zariphopoulou (2007) recently introduced a structural model, in which default of the reference entity is triggered by a credit worthiness index correlated to its stock price. In an unrelated paper, Uppal and Wang (2003) study portfolio optimization when model parameters are unknown. We combine these two approaches and derive some analytical and numerical results.

Ling-Wu Shao, Schulich School of Business.

### Asset Allocation (portfolio choice) with fixed and variable annuities, a simplified 3-period example

I am investigating the traditional asset allocation problem of a retired investor in a discrete 3-period model with highly simplified assumptions on asset returns and mortality probabilities. The investor is assumed to choose from a risky asset, a riskless asset, and either a riskless fixed annuity or a risky variable annuity. I examine 3 cases:

- 1) The investor faces deterministic mortality probabilities and is offered a fixed fair annuity,
- 2) The investor faces stochastic mortality probabilities and is offered a fixed annuity that is fair given risk-neutrality,
- 3) The investor faces stochastic mortality probabilities and is offered a fair variable annuity. I will also discuss how I plan to build this simple model into a more complicated model to solve.

Yun Qiao, Dept. of Math & Statistics, York University

### Guaranteed Minimum Withdrawal Benefits from an investor's perspective

I'll introduce guaranteed minimum death benefits (GMWBs), which are investment guarantees bundled with baskets of individual securities. They can be regarded as an insurance policy for an investment portfolio, and are popular as a vehicle for retirement savings. My thesis will use stochastic control theory and viscosity analysis to look at some optimization problems

associated with GMWBs. So far I've been working on a viscosity analysis of some hedging problems, originally studied by Milevsky and Salisbury.

Mirela Cara, Dept. of Math & Statistics, York University

Probability of Lifetime Ruin in the Case of Wealth Dynamics with Jumps

If a retiring investor's wealth follows a stochastic differential equation with both diffusion and jump terms, we can derive a partial integro-differential equation (PIDE) that models this individual's probability of lifetime ruin. This is defined as the probability that the investor's wealth will be exhausted within his lifetime. I will propose a numerical method which solves the PIDE for a general case where the jump amplitudes are selected from a pre-specified probability distribution and at the specific case with log-uniformly distributed jump-amplitudes.