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Overview

The Summer School bridges the gap between a general graduate education in quantitative finance and the specific preparation necessary to do research on problems of current interest in the subject. In general, students who attend the Summer School should have completed their first year, and in some cases, may already be working on a thesis. While a majority of the participants will be graduate students, some senior undergraduates, postdoctoral scholars, and young researchers may also be interested in attending.

Organizers

- Yongluo CAO (Soochow University)
- Min DAI (National University of Singapore & NUS (Suzhou) Research Institute)
- Weinan E (Princeton University & Peking University)
- Steven KOU (National University of Singapore & NUS (Suzhou) Research Institute)
- Xingye YUE (Soochow University)

Sponsors

- Center for Mathematics and Interdisciplinary Sciences & Center for Financial Engineering, Soochow University
- Risk Management & Quantitative Finance Centre, NUS (Suzhou) Research Institute (founded by Centre for Quantitative Finance and Risk Management Institute)
## Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Name of Speakers &amp; Talk Titles</th>
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| 4 July 2015 | 9:00am - 12:00pm  | Ulrich HORST  
*Optimal Portfolio Liquidation under Market Impact*  
2:30pm - 5:30pm  
Min DAI  
*Variational Inequality Equations in Option Pricing and Optimal Investment* |
| 5 July 2015 | 9:00am - 12:00pm  | Ulrich HORST  
*Optimal Portfolio Liquidation under Market Impact*  
2:30pm - 5:30pm  
Min DAI  
*Variational Inequality Equations in Option Pricing and Optimal Investment* |
| 6 July 2015 | 9:00am - 12:00pm  | Min DAI  
*Variational Inequality Equations in Option Pricing and Optimal Investment*  
2:30pm - 5:30pm  
Hanqing JIN  
*Portfolio Selection Theory* |
| 7 July 2015 | 9:00am - 12:00pm  | Hanqing JIN  
*Portfolio Selection Theory*  
2:30pm - 5:30pm  
Hanqing JIN  
*Portfolio Selection Theory* |
| 9 July 2015 | 9:00am - 12:00pm  | Shijie DENG  
1:30pm - 4:30pm  
Shijie DENG  
| 10 July 2015 | 9:00am - 12:00pm | Steven KOU  
*Arbitrage Pricing Theory*  
2:30pm - 5:30pm  
Duan LI  
*Discrete Time Mean-Variance Portfolio Selection* |
| 11 July 2015 | 9:00am - 12:00pm | Steven KOU  
*Arbitrage Pricing Theory*  
2:30pm - 5:30pm  
Duan LI  
*Discrete Time Mean-Variance Portfolio Selection* |
| 12-13 July 2015 | Singapore-Suzhou Workshop on Quantitative Finance  
Venue: National University of Singapore (Suzhou) Research Institute  
No. 377, Linquan Street, Level 2, Block 3, Public Academy, Dushu Lake Science and Education Innovation District, Suzhou Industrial Park, Suzhou, Jiangsu, China 215123 |
Abstract

Variational Inequality Equations in Option Pricing and Optimal Investment
Min DAI, National University of Singapore, Singapore

I will talk about some variational inequality equations arising from finance, including 1) optimal stopping arising from option pricing and investment strategy which can be formulated as standard variational inequality equations; 2) optimal investment with transaction costs and/or capital gain taxes which can be formulated as variational inequality equations with gradient constraints. These variational inequality equations give rise to free boundaries that correspond to optimal strategy. Numerical algorithms will also be discussed.

Shijie DENG, Georgia Institute of Technology, United States

We present several research problems arising from the U.S. energy markets. Through collaborations with power market participants such as power merchants, utilities and Independent System Operators, our research yield solutions which address a variety of issues on the power market auction design analysis, electricity derivatives pricing, energy asset valuation, hedging of weather and volumetric risks, and design of financial instruments in carbon emission markets.
Optimal Portfolio Liquidation under Market Impact
Ulrich HORST, Humboldt University Berlin, Germany

In this course we review mathematical models of portfolio liquidation under market impact both in discrete and continuous time. We shall start with a discussion of limit order books and alternative trading venues such as dark pools. Subsequently, we discuss the discrete-time model of optimal portfolio liquidation in dark pools in discrete time analyzed in Kratz and Schoneborn (2014). Optimal liquidation models in continuous time are mathematically more challenging. Their main mathematical feature is a singularity of the value resulting from the liquidation constraint at the terminal time. The 3rd and 4th lecture will be based on the continuous time model of Horst and Graewe (2014). The last two lectures are devoted to the model with permanent market impact analyzed in Horst and Naujokat (2013). Although we shall review basic methods and techniques of stochastic optimal control, students not familiar with stochastic optimal control are encouraged to read Chapters 3 and 6 of Pham’s book.

References:


Portfolio Selection Theory
Hanqing JIN, University of Oxford, England

This course aims to introduce standard theories on portfolio selection and some non-standard ones at the cutting edge. The course will start from single-period model, followed by the Black-Scholes continuous-time model. A new part will be introduced for the behavioral portfolio selection and the general quantile formulation.

Contents:

• Single-period Models: Expected Utility and Mean-Variance (1 hour)
• Continuous-time Market Model: Black-Scholes Markets (1 hour)
• Stochastic Control (1 hour)
• Expected utility Maximisation (1 hour)
• Mean-Variance (1 hour)
• Martingale/Dual Approach (2 hours)
• Behavioural portfolio selection and quantile formulation (2 hours)

References:

Steven E. Shreve, Stochastic Calculus for Finance II

Yong J. and X. Y. Zhou, Stochastic Controls: Hamiltonian Systems and HJB Equations


Arbitrage Pricing Theory
Steven KOU, National University of Singapore, Singapore

In these lectures, we will give an overview of (1) the basic definition of arbitrage, law of one price (2) the fundamental theory of asset pricing (3) modern arbitrage pricing theory (Ross, 1976, Ingersoll, 1984, Fama and French, 1993, 2012) and (4) its application to asset pricing with spatial interactions.
Discrete Time Mean-Variance Portfolio Selection
Duan Li, The Chinese University of Hong Kong, Hong Kong

We introduce in this 6-hour short course the background and mathematical formulations of discrete time mean-variance portfolio selection, present its solution schemes, and highlight the state-of-the-art in the field. We will develop the course centered on the issue of time inconsistency, its challenge to stochastic control, and remedy strategies.

References:


X. Y. Cui, D. Li and X. Li, Mean-variance policy for discrete-time cone-constrained markets: Time consistency in efficiency and the minimum-variance signed supermartingale measure, accepted for publication in *Mathematical Finance*, 2014.