THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

DEPARTMENT OF APPLIED MATHEMATICS
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Seminar

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Topic

Sensitivity Analysis of Robust Optimization Problems and Nonlinear Kolmogorov PDEs

Date| Time

10 April 2024 (Wednesday) | 16:30 – 17:30 (HK Time)

Venue

Z406, Main Campus

Abstract

In this talk we provide sensitivity analysis of robust optimization problems and nonlinear Kolmogorov partial differential equations (PDEs). In the optimization problems, an investor has the opportunity to trade in a stock with the goal of maximizing her worst-case cost of cumulative gains and losses. Here, worst-case refers to taking into account all possible drift and volatility processes for the stock that fall within a ε-neighbourhood of predefined baseline processes. Our goal is to quantify how sensitive a given robust optimization problem is to model uncertainty, which can be attained by showing that the robust problem can be approximated as $\varepsilon \downarrow 0$ by the baseline problem (computed using the baseline processes). In the nonlinear Kolmogorov PDEs, the nonlinearity comes from its Hamiltonian where one maximizes over all possible drift and diffusion coefficients which fall within a ε-neighborhood of pre-specified baseline coefficients. Our subsequent aim is to quantify how sensitive those PDEs are to such a small nonlinearity, and then use the results to develop an efficient numerical method for their approximation. We show that as $\varepsilon \downarrow 0$, the nonlinear Kolmogorov PDE can be approximated by the linear Kolmogorov PDEs involving the baseline coefficients. As these linear Kolmogorov PDEs can be efficiently solved in high-dimensions by exploiting their Feynman-Kac representation, our derived sensitivity analysis then provides a Monte Carlo based numerical method which can efficiently solve these nonlinear Kolmogorov PDEs.

This talk is based on joint works with Daniel Bartl (Univ. Vienna) and Ariel Neufeld (NTU Singapore).

ALL ARE WELCOME