TM5101
Continuous-Time Financial Mathematics

（連續時間財務數學）

This course provides a probabilistic way in depth to establish no arbitrage asset pricing theory under several financial markets and contingent claims. We focus on financial interpretations of mathematical modeling for risky asset dynamics. Applications of Monte Carlo simulations in financial engineering will be discussed along with the development of this course. Beyond classical financial models, Levy process and its pricing and hedging theory will be addressed.

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Class Time: W2W3W4 (9:00AM - 12:00AM)
Classroom Location: Room 101, Research and Development Bldg (研發101)

Prerequisities:

Courses equivalent to TM5091 Stochastic Calculus for Finance (Ito's calculus)

Text: Steven E. Shreve, "Stochastic Calculus for Finance II: continuous-Time Models," Springer-Verlag, 2003.

References:

1. Damien Lamberton and Bernard Lapeyre, "Introduction to Stochastic Calculus Applied to Finance,"Springer, (1 edition) 1996.
2. P. Glasserman, Monte Carlo Methods for Financial Engineering, Springer-Verlag, New York, 2003.

Course Contents:

1. Stochastic differential equations for finance (the Markov property, interest rate models, multi-dimensional Feynman-Kac theorems, SDE discretization schemes)
2. Pricing some exotic options (knock-out barrier options, lookback options, Asian options, control variate method, dimension reduction PDEs)
3. American derivative securities (stopping times, American put and call options, free boundary problems, least-squares and duality methods)
4. Change of numeraire (numeraire, foreign and domestic risk-neutral measures, forward measures, importance sampling)
5. Term structure models (affine-yield models, Heath-Jarrow-Morton model, forward LIBOR model)
6. Introduction to Levy processes (Poisson process, compound Poisson process, jump processes and their Integrals, stochastic calculus for jump processes, change of measure, pricing and hedging a European Call in a Jump model, PIDE)
7. Topics on Stochastic Volatility: Perturbation methods, Averaging effect, Applications to credit risk.

Grading:

Assignments 40%, Exams(midterm and final) 40%, Course Project 20%.