QF 5215
Computational Finance

（計算金融）

This course aims to introduce financial models and their computational methods with various applications. Numerical methods include numerical partial differential equation methods, fast Fourier transform methods, and Monte Carlo simulation methods. GPU based parallel computing and portfolio optimization will be discussed. We then apply these results for empirical studies. For example, dynamic volatility matrix estimation, option hedging performance, VaR/CVaR estimation in risk management, and model calibration to implied volatility surfaces.

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Class Time: W2-4
Classroom Location: 台積館 735

Textbooks:

1. 韓傳祥, “金融隨機計算,” 新陸書局, 2012.
2. Lecture Notes provided.

References:

1. J. Kienitz and D. Wetterau. Financial Modeling: Theory, Implementation and Practice with Matlab source. Wiley Finance. 2012.

2. P. Jackel, “Monte Carlo Methods in Finance,” John Wiley & Sons Ltd. 2002.

3. P. Glasserman, “Monte Carlo Methods for Financial

Engineering," Springer-Verlag, New York, 2003.

Course Contents:

1. Numerical PDE method (finite difference scheme).
2. Fourier Transform Method (Fast Fourier Transform).
3. Volatility/correlation estimation.
4. Monte Carlo simulation.
5. Pricing some exotic options (barrier options, lookback options, Asian options, dimension reduction PDEs).
6. American derivative securities (stopping times, American put and call options, free boundary problems, least-squares and duality methods).
7. Variance Reduction Method.
8. VaR/CVaR estimation in risk management. (historical simulation, importance sampling)
9. Term structure models (affine-yield models, Heath- Jarrow-Morton model, forward LIBOR model)
10. Credit risk modeling. Joint Default Probability Estimation.
11. Portfolio Optimization. (Entropy-based importance sampling).
12. GPU computing.
13. Applications of empirical studies.

Grading:

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