

**Topic 1:** Efficient finite difference method for calculation of Greeks based on ADI and operator splitting method for stochastic interest-rate model (Prof. Chenglong Xu: clxu@tongji.edu.cn)

**Description:** Option pricing under stochastic interest-rate model can be considered as a generalization of classical BS formula, since there is no closed-form solution formula of option price in this case, some methods, such as the finite difference method, Monte carlo simulation method are used for option pricing. By operator splitting technique, ADI method and the singularity removing technique, the pricing problem of option and the calculation of Greeks (sensitivity of option price with financial coefficients ) can be solved efficiently. .

**Topic 2:** Monte Carlo acceleration method for Risk measure for portfolios of assets (Prof. Chenglong Xu: clxu@tongji.edu.cn)

**Description:** Risk measure is important in finance engineering. Since the **nonlinear character** of the value of a general portfolios of assets, it is important to develop a efficient Monte Carlo method to determine the default **probability and LGD**. **Our aim is to design a efficient Monte Carlo algorithm based on the conditional expectation formula and the idea of importance sampling technique to acceleration the simulation.**

**References for problem 1-2:**

[1].Dingec, K. D., Hormann, W. (2013): Control variates and conditional monte carlo for Basket and Asian options. Insurance Mathematics Economics, 52(3), 421-434.

[2]. Glasserman, P. (2004): Monte Carlo Methods in Financial Engineering. Springer.

**Topic3:** Dynamic Updated SimRank for Large Social Networks (Associate Prof. WeiXu: wdxu@tongji.edu.cn)

**Description:** SimRank is an important measure for the similarity of two users on the social network. However, due to the large scale of the network, it is expensive to recalculate the SimRank each time when the statuses of a few users on the network are updated. In this project, we will explore some dynamic methods to save the cost for each update.

**Topic 4:** Multi-Assets Portfolios Data Resampling (Associate Prof. WeiXu: wdxu@tongji.edu.cn)

**Description:** In this project, we will explore how to resample from multi-asset portfolios data so that the resamples can match the distribution data as much as possible so that the portfolio valuation and risk management can be efficient and accurate.