

22S:273 Advanced Topics in Actuarial Science - Stochastic Analysis for Insurance and Finance

Instructor: Dr. Qihe Tang

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- Course Schedule: 12:30-2:00p.m., Tuesday and Thursday, N100 LC
- Office Hours: 10:30-11:30a.m., Monday, Wednesday and Friday, or by appointment

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Main References

- Shreve, Steven E. Stochastic calculus for finance. I. The binomial asset pricing model. Springer Finance. Springer-Verlag, New York, 2004.
- Shreve, Steven E. Stochastic calculus for finance. II. Continuous-time models. Springer Finance. Springer-Verlag, New York, 2004.
- Klebaner, Fima C. Introduction to stochastic calculus with applications. Second edition. Imperial College Press, London, 2005.
- Lin, X. Sheldon Introductory stochastic analysis for finance and insurance. Wiley-Interscience [John Wiley & Sons], 2006.
- Etheridge, Alison A course in financial calculus. Cambridge University Press, Cambridge, 2002.
- Baxter, Martin; Rennie, Andrew Financial calculus: an introduction to derivatives pricing. Cambridge University Press, 1996.
- Karatzas, Ioannis; Shreve, Steven E. Brownian motion and stochastic calculus. Second edition. Springer-Verlag, New York, 1991.
- A list of selected papers in the recent literature of actuarial science and mathematical finance.

Content and Description

For a very long period people working in actuarial science have only considered the insurance portfolio in a world without economic factors. This is very unrealistic because insurers always make investments. Therefore, we should also consider the investment portfolio. This leads to a stochastic economic environment, in which the wealth of the insurer is described as a complicated stochastic process. This more realistic asset-liability model builds a platform both for actuarial science and for mathematical finance, and relates modern stochastic calculus techniques to classical risk theory.

In this course, we study some of the main methodological issues underlying stochastic calculus for finance, in hope for their new applications to actuarial science. Topics treated include: introduction to probability theory, American derivative securities, Brownian motion, the Itô integral and Itô's formula, the Black-Scholes model, Martingale representation theorem, pricing options, and so on.

The course aims to provide hints for interested students who want to deepen their knowledge in various areas of actuarial science and mathematical finance.

Evaluation System

Around the middle of October, I shall select a list of papers from the recent literature. I shall ask each of you to pick up one from the list, to seriously study it, to discuss it with each other, and to give a 20-minute presentation on it.

Everyone is encouraged to report in class a specific chapter from the main references.

I may use two grading systems: A/B/C/D and Satisfactory/Unsatisfactory. Both are based on your performance during the whole semester. You have the right to choose one of them. Those who choose the A/B/C/D grading system will be requested to do a certain amount of homework. Let me know your personal preference by the end of October.