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Research field: Probability Theory and Statistics

Keywords: Stochastic Analysis, Mathematical Finance

Current research

I am doing research on various topics related to uncertain phenomena, in particular, on Malliavin calculus and Mathematical Finance.

The contents of research is as follows.

- (1) Computational Finance
- (2) Hedging risk and measuring risk
- (3) Limit theorem on deriving Brownian motion from Newtonian dynamics of classical mechanics with random initial conditions.
- (4) Equations for family of probability measures related Mathematical Finance (Supermartingale problems)

Prerequisites

Students must master martingales, stochastic integrals and stochastic differential equations to understand modern theory on stochastics, and so I will request students to study about them heavily.

For this purpose, students must study and get knowledge and understanding on General Topology, Measure Theory, Fourier Analysis and Hilbert Spaces before entering to the Graduate School.

Also, they must have knowledge on elementary probability theory based on measure theory before.

I hope students to study all fields of mathematics if they have time to do it, because we may need knowledge on any fields of mathematics, algebra, geometry, analysis etc., to do research on probability theory.

Students also need the following knowledge depending on the choice of a major.

1. Students who choose Stochastic Analysis as a major

The topics on Stochastic Analysis guided in my institute is a kind of infinite dimensional analysis.

So students need the following knowledge.

- (1) Functional Analysis (Banach spaces, Semigroups of linear operators, Function Spaces)
- (2) Malliavin Analysis

2. Students who choose Mathematical Finance as a major

The topics on Mathematical Finance guided in my institute is based on strictly mathematical theory, and even positive research must be on this base.

So students need the following knowledge.

(1) Functional Analysis (it is necessary to understand fundamental theorems on Finance)

(2) Statistics

(3) Numerical Analysis

Experience is desirable to do computation by using a computer.