Stochastic Control Theory

Lecture course

(Fall semester 2014)

Dr. Michael Pokojovy

- **Credits:** 6 ECTS
- **Schedule:**

  Lecture: Mo., 11:45 am – 1:15 pm
  Wed., 11:45 am – 1:15 pm

Description:

In this course, we give an overview on classical stochastic control theory. For a dynamical random system modeled by a finite-dimensional stochastic differential equation depending on a parameter or a strategy, one is often interested in selecting this strategy in order to minimize a cost functional or to maximize a utility functional over a finite or an infinite time horizon. A similar question arises when solving a filtering problem to optimally estimate the unknown signal based on the measurements from a noisy sensor, etc. These are typical problems arising in mathematical finance and economics, physics and engineering, information sciences, etc.

After discussing existence and uniqueness results as well as an asymptotics theory for stochastic differential equations, we exploit the dynamic programming principle to solve the optimal control problem. Next, we consider the filtering problem and deduce some classical filters, e.g., the Kalman-Bucy one. Finally, we address the optimal stopping problem and briefly discuss the case of impulse control. Further topics if time allows will include backwards stochastic differential equations and their connection to stochastic control, etc.

As for the minimum course requirements, in addition to elementary calculus, the participants are expected to have a strong background in probability theory and random processes. Basic knowledge of optimization, functional analysis and the theory of partial differential equations is advantageous, but not necessary.

Requirements:

- Calculus 1–4
- Stochastics 1, 2
- Optimization (optional)
- PDE (optional)