Course title:

Stochastic differential equations and singular stochastic control

Duration [number of hours]: 24

PhD Program [MERC/MPS/SPACE]: MERC

Name and Contact Details of Lecturer:

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Course Description [max 150 words]:

Over the past few decades stochastic differential equations and singular stochastic control have become powerful mathematical tools to address practical problems from a broad range of disciplines, including physics, engineering, economics and social sciences. The objective of the course is to provide a self-contained introduction to the subject for non-experts and a selection of tractable problems. On successful completion of the course, the students are expected to acquire the essential skills needed to formalize new stochastic control problems in the applicative domains of their interest.

Syllabus [itemized list of course topics]:

1) Brownian motion and stochastic calculus: probability spaces, continuous time stochastic processes, Brownian motion, construction of the Ito integral, the Ito formula.
2) Stochastic differential equations and PDE's: stochastic differential equations, the generator of an Ito diffusion, connection with PDE's.
3) Singular stochastic control and connections with optimal stopping: controlled diffusion processes, dynamic programming, the Hamilton-Jacobi-Bellman equation, free boundary problem. Verification theorems. Applications in finance, economics and engineering.

Assessment [form of assessment, e.g. final written/oral exam, solutions of problems during the course, final project to be handed-in etc]:

Solutions of problems during the course:
Weekly assignments on some challenging problems will be handed out to the students that must solve the problems and discuss the solutions during one of the following lectures.

Suggested reading and online resources:

1. B. Øksendal, 2003. Stochastic Differential Equations: An Introduction with Applications, Springer-Verlag Heidelberg New York
2. H. Pham, 2009. Continuous-time Stochastic Control and Optimization with Financial Applications, Springer- Verlag Berlin Heidelberg