

Brownian Motion and Stochastic Differential Equations

the 4th course in the Finnish Graduate School in Stochastics and Statistics' cycle *Basic Graduate Courses in Probability and Stochastic Processes* will be given as a one-week intensive course by Professor Stefan Geiss (University of Jyväskylä) **May 21st–25th 2007** at Department of Mathematics, Tampere University of Technology.

Course description and prerequisites

Stochastic differential equations are a fundamental tool in mathematics and its applications. Given a Brownian motion $W = (W_t)_{t \geq 0}$, a stochastic differential equation reads, for example, as

$$dX_t = a(t, X_t)dt + b(t, X_t)dW_t.$$

Here, given the coefficients a and b , we look for an appropriate stochastic process $(X_t)_{t \geq 0}$ as solution. But what is the meaning of this equation, or starting from the very beginning: what is a Brownian motion and a stochastic differential? The course intends to answer some of these questions and consists of three parts:

- Introduction of the Brownian motion as a fundamental stochastic process with surprising properties.
- Itô's integral and Itô's formula as the stochastic Taylor formula.
- Stochastic differential equations.

Number of study points (opintopisteet, op): 4

Prerequisites: Basic knowledge in probability theory.

Literature:

- [1] A.N. Borodin and P. Salminen: Handbook of Brownian motion – facts and formulae, Birkhäuser.
- [2] S. Geiss: Stochastic differential equations (lecture notes), www.maths.jyu.fi/~geiss/scripts.html.
- [3] I. Karatzas and S. Shreve: Brownian motion and stochastic calculus, Springer.
- [4] D. Revuz and M. Yor: Continuous martingales and Brownian motion, Springer.

Schedule and location

Lectures take place 9:00 - 13:00 and exercise sessions 14:00 - 16:00 each day (Monday 21th–Friday 25th) in the seminar room of the Department.

Teachers

Lectures: *Stefan Geiss*

Exercises: *Matti Vihola*

Registration and accommodation

Please register by sending email to

teppo.rakkolainen@tse.fi

Registration deadline is **April 12th 2007**. There is no course fee. A limited number of rooms have been reserved for participants in hostel *Uimahallin maja*. The participants should contact the hostel to arrange their accommodation:

Hostel reception: sales@hosteltampere.com

Phone: (03) 222 9460

Fax: (03) 222 9940

Address: Pirkankatu 10-12, 33230 TAMPERE

The Graduate School will pay Ph.D. students' accommodation (including breakfast) and reimburse their travelling expenses.