Mini-course on numerical methods for SDEs

given by Prof. Michael Tretyakov (University of Nottingham)
http://www.umu.se/utbildning/program-kurser/kurs/?code=5MA168

Course description.
The mini-course is designed to give an accessible introduction to numerical discretisation of stochastic differential equations (SDEs). Prerequisites will be kept to a minimum. We assume only a basic competence in calculus (including ordinary differential equations) and probability. Some familiarity with fundamental concepts from numerical analysis is also desirable, but not absolutely necessary. We will mention some open research problems and discuss applications in molecular dynamics and financial engineering.

Topics:

- Basics of stochastic processes and SDEs
- Numerical methods for SDEs – the mean-square sense
- Numerical methods for SDEs – the weak sense
- Basics of the Monte Carlo technique and variance reduction
- Computing ergodic limits
- Stochastic geometric integration
- Applications in molecular dynamics and finance

Form of education:

- Lectures
- Computer labs and home assignments

Teacher.
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Dates and tentative schedule.
Tuesday 30.08: 4 lectures.
Wednesday 31.08: 3 lectures and 1 computational lab.
Thursday 01.09: 3 lectures and 1 computational lab.
Friday 02.09: 2 hours of consultation.

Target Audience.
Master students. PhD students. Students from mathematics, mathematical statistics, physics, industrial economics and other sciences are welcome.

Required knowledge.
Basic knowledge in calculus, probability, and numerical analysis. Knowledge of programming in MatLab may be useful for the computer exercises.

References on Numerics for SDEs.
G.N. Milstein and M.V. Tretyakov: *Stochastic Numerics for Mathematical Physics*,
http://www.springer.com/gb/book/9783540211105

C. Graham and D. Talay: *Stochastic Simulation and Monte Carlo Methods*,
http://www.springer.com/gp/book/9783642393624

P. Glasserman: *Monte Carlo Methods in Financial Engineering*,
http://www.springer.com/gb/book/9780387004518

P.E. Kloeden and E. Platen: *Numerical Solution of Stochastic Differential Equations*,
http://www.springer.com/us/book/9783540540625

References on SDEs.
X. Mao: *Stochastic Differential Equations and Applications*,
https://www.elsevier.com/books/stochastic-differential-equations-and-applications/mao/978-1-904275-34-3

F.C. Klebaner: *Introduction to Stochastic Calculus with Applications*,
http://www.worldscientific.com/worldscibooks/10.1142/p821

L.C. Evans: *An Introduction to Stochastic Differential Equations*,
http://www.ams.org/bookstore-getitem/item=mbk-82

I. Karatzas and S.E. Shreve: *Brownian Motion and Stochastic Calculus*,
https://www.springer.com/us/book/9780387976556

Credit points.
3 ECTS

Organisers.
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