Stochastik IV:
Stochastic and diffusive processes

Dr. Luca Donati

Zuse Institute Berlin
Modeling and Simulation of Complex Processes
Computational Molecular Design

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Important information

The course will be held on

- Tuesday (lecture): 12-14 in Takustrasse 9, SR 049
- Tuesday (tutorial): 14-16 in Arnimallee 6, SR 009

Effective time

- Tuesday (lecture): 12.15-13.45 in Takustrasse 9, SR 049
- 30 minutes break
- Tuesday (tutorial): 14.15-15.45 in Arnimallee 6, SR 009

Structure of the course: Lectures

- Introduction to Brownian motion.
- The master equation and the Fokker-Planck equation.
- Stochastic calculus and stochastic differential equations.
- Methods to solve stochastic differential equations.
- Methods to solve the Master equation: Gillespie algorithm.
- Methods to solve the Fokker-Planck equations: MSMs and SqRA.
- Robust Perron Cluster Cluster Analysis (PCCA+).
- Estimating transition rates by Neural Networks.
- The Kramers problem.
- The Generalized Langevin equation.

Structure of the course: Exercises

- The tutorial includes both pen-and-paper exercises and computational exercises.
- Exercises are uploaded on Tuesday evenining
- Exercises will be solved on the blackboard the following Tuesday

Literature

- **Lecture Notes** (uploaded on whiteboard on a weekly basis)

Suggested literature

- Gardiner, C., Stochastic Methods: A Handbook for the Natural and Social Sciences, 2009.
- Risken, H., The Fokker-Planck Equation: Methods of Solution and Applications, 1984.
- Oksendal, B., Stochastic Differential Equations: An Introduction with Applications, 2010.
- Articles provided by the lecturer.

Exam

- The exam will be oral and will generally last about 40 minutes.
- In December the lecturer will provide 8-9 main topics of the course. Topics are chosen to cover the entire course.
- Students will prepare a 30 minutes blackboard presentation for each topic.
- At the beginning of the exam, one topic will be randomly chosen for each student.
- Students will present their presentation on the topic without interruptions (unless serious errors emerge during the presentation).
- Questions about the chosen topic, or other topics, will be addressed in the last 5-10 minutes.