

## Course overview

- Transformations and weak solutions of stochastic differential equations
- Lévy processes and Poisson point processes; SDE with jumps
- Extensions of Ito calculus, stochastic flows
- Stability of SDE, variations and coupling for diffusion processes
- Numerical methods for SDE and (Markov Chain) Monte Carlo
- Possibly outlook to Stochastic partial differential equations

## Recommended textbooks

The following standard textbooks cover all a broad range of topics in stochastic analysis. Nevertheless, there are substantial differences in style and content between them.

- Rogers, Williams : *Diffusions, Markov processes and martingales, Vol. 2: Ito calculus*, Cambridge UP.
- Bass : *Stochastic Processes*, Springer.
- Applebaum: *Lévy Processes and Stochastic Calculus*, Cambridge UP.
- Protter : *Stochastic integration and differential equations*, Springer.
- Revuz, Yor : *Continuous martingales and Brownian motion*, Springer.
- Le Gall: *Brownian motion, martingales, and stochastic calculus*, Springer.
- Karatzas, Shreve : *Brownian motion and stochastic calculus*, Springer.
- Ikeda, Watanabe: *SDE and diffusion processes*, North Holland.
- Jacod/Shiryayev: *Limit Theorems for Stochastic Processes*, Springer.

### Additional references:

- Durrett : *Stochastic calculus*, CRC Press. (Diffusion processes, connections to partial differential equations, approximations)
- Hackenbroch, Thalmaier: *Stochastische Analysis*, Teubner. (Strong solutions, stochastic calculus on manifolds)
- Seppalainen: *Basics of Stochastic Analysis*, <http://www.math.wisc.edu/~seppalai/bookpage.html> . (Stochastic integration theory for processes with jumps)
- Da Prato: *Introduction to Stochastic Analysis and Malliavin Calculus*, SNS Pisa. (Infinite dimensional analysis, Malliavin calculus)
- Friedman: *Stochastic Differential Equations and Applications*, Dover.
- Liptser/Shiryev: *Statistics of Random Processes I and II*, 2 nd Ed., Springer.
- Shreve: *Stochastic Calculus for Finance II*, Springer.