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Institut für Mathematik  
Bereich Stochastik



In the summer term 2023 I will teach the course (**module M24**):

## *Stochastic Analysis* *(Stochastic Processes II)*

The course will be given in English to facilitate participation by international students.

### Content:

Gaussian processes; Brownian motion, construction and properties; filtrations and stopping times; continuous time martingales; continuous semimartingales; quadratic variation; stochastic integration; Itô's formula; stochastic differential equations and diffusion processes, probabilistic representations for partial differential equations. Girsanov's theorem and change of measure; Itô's martingale representation property.

### Prerequisites:

Analysis I-III (incl. measure theory), Stochastics II (BMS title: Stochastic Processes I).  
Helpful and beneficial will be interest and/or knowledge in Functional Analysis and PDE theory.

### References:

- Le Gall, J.-F.: [Brownian Motion, Martingales, and Stochastic Calculus \(Graduate Texts in Mathematics\)](#), 1<sup>st</sup> ed. 2016 Edition, Springer.
- Karatzas, I., Shreve S.: Brownian motion and stochastic calculus. Vol. 113. Springer, 2012.
- Klenke, A.: [Wahrscheinlichkeitstheorie](#), Springer, 2008., English version: Probability theory: a comprehensive course. In particular chapters 21, 25, 26. Springer, 2014.
- Revuz, D., and Yor, M.: [Continuous martingales and brownian motion](#). 3<sup>rd</sup> ed. Springer, 1999.
- Rogers, L.C.G., Williams, D.: Diffusions, Markov processes and martingales, Vol. 1 & 2, Cambridge University Press, 2000.
- Jacod, J., and Shiryaev, A.N.: Limit theorems for stochastic processes., Springer, 2003.
- Jacod, J.: Calcul stochastique et problèmes de martingales. LNM No. 714, Springer, 1979
- Jacod's, J. [lecture notes](#) (in French).
- Kallenberg, O.: [Foundations of modern probability](#). Springer, 1997.
- Mörters, P., and Peres, Y.: Brownian motion, 1<sup>st</sup> ed. Cambridge University Press, 2010, see <http://yuvalperes.com/>

### Lectures (**first lecture: Tue 18.4.23**)

Mon., 09 – 11, RUD25 room 1.115  
Tue., 11 – 13, RUD25 room 1.115

### Classes (**first class Tue 25.4.23**)

Tue., 15 – 17, RUD25 room 1.115

Current information about current times for lectures and classes will be posted on Moodle:  
please check AGNES and <http://www.math.hu-berlin.de/~becherer/> for further information.

Teaching assistant: Mr. Sun Yuchen (sunyuche+at+math.hu-berlin.de)  
Office hours by appointment.