Short course on numerical methods for stochastic processes

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A stochastic process is a collection of random variables parameterized by time. It often serves as a mathematical description of a system or phenomenon that is influenced by some randomness. Examples include the growth of a bacterial population, the motion of a molecule, or the dynamics of the financial market.
Often stochastic processes are described by stochastic differential equations (SDEs). The mathematical treatment of SDEs requires a specific calculus and numerical simulation methods for SDEs have to be consistent with the corresponding stochastic calculus.

This course serves as an introduction to the theory and especially the numerical analysis of stochastic processes.

Topics:

- Generation of random numbers and variables
- Monte Carlo simulation
- Variance-reduction techniques
- Continuous time stochastic processes
- Stochastic differential equations
- Numerical solution of SDEs
- ...

In the practical part of the course, we will apply the results from the lectures to different example systems. This also means that we will implement and run the models and algorithms in MATLAB.

References:

Kloeden/Platen: Numerical solutions of stochastic differential equations (Springer)
Asmussen/Glynn: Stochastic simulation: algorithms and analysis (Springer)
Øksendal: Stochastic differential equations - an introduction with applications (Springer)