MATH-450

Numerical integration of stochastic differential equations

Blumenthal Adrian

Cursus	Sem.	Type
Computational science and Engineering	MA2, MA4	Opt.
Financial engineering	MA2, MA4	Opt.
Ing.-math	MA2, MA4	Opt.
Mathematics for teaching	MA2, MA4	Opt.
Mathématicien	MA2	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Written
Workload	150h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

In this course we will introduce and study numerical integrators for stochastic differential equations. These numerical methods are important for many applications.

Content

Introduction to stochastic processes
Ito calculus and stochastic differential equations
Numerical methods for stochastic differential equations (strong and weak convergence, stability, etc.)
Stochastic simulations and multi-level Monte-Carlo methods

Learning Prerequisites

Recommended courses

Numerical Analysis, Advanced probability

Learning Outcomes

By the end of the course, the student must be able to:

- Analyze the convergence and the stability properties of stochastiques numerical methods
- Implement numerical methods for solving stochastic differential equations
- Identify and understand the mathematical modeling of stochastic processes
- Manipulate Ito calculus to be able to perfom computation with stochastic differential equations
- Choose an appropriate numerical method to solve stochastic differential equations

Teaching methods

Ex cathedra lecture, exercises in classroom

Assessment methods

Written examination (in case of failure the second exam will be an oral examination).
Dans le cas de l'art. 3 al. 5 du Règlement de section, l'enseignant décide de la forme de l'examen qu'il communique aux étudiants concernés.

Supervision

Office hours	Yes
Assistants	Yes
Forum	No

Resources

Ressources en bibliothèque

- An Introduction to Stochastic Differential Equations / Evans
- Numerical Solution of Stochastic Differential Equations / Kloeden
- Stochastic Numerics for Mathematical Physics / Milstein

Notes/Handbook

L. Arnold, "Stochastic Differential Equations, Theory and applications", John Wiley & Sons, 1974
L.C. Evans, "An Introduction to Stochastic Differential Equations", AMS, 2013
P.E. Kloeden, E. Platen, "Numerical Solution of Stochastic Differential Equations", Springer, 1999.
H-H. Kuo, "Introduction to Stochastic Integration", Springer, 2005.
G.N. Milstein, M.V. Tretyakov, "Stochastic Numerics for Mathematical Physics", Springer, 2004.

Websites

- http://anmc.epfl.ch