

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.
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 stochastic 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 perform 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

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.

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.