MATH-452 **Numerical integration of dynamical systems**

Cursus	Sem.	Type
Computational science and Engineering	MA1, MA3	Opt.
Ing.-math	MA1, MA3	Opt.
Mathematics for teaching	MA1, MA3	Opt.
Mathématicien	MA1, MA3	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Written
Workload	150h
Weeks	14
Hours	**4 weekly**
Lecture	2 weekly
Exercises	2 weekly
Number of positions	

Remark

pas donné en 2017-18

Summary

In this course we will introduce and study numerical integrators for multi-scale (or stiff) differential equations and dynamical systems with special geometric structures (symplecticity, reversibility, first integrals, etc.). These numerical methods are important for many applications.

Content

- Numerical integration of multi-scale or stiff differential equations.
- Numerical methods preserving geometric structures of dynamical systems (Hamiltonian systems, reversible systems, systems with first integrals, etc.

Learning Prerequisites

Recommended courses

Analysis, Numerical Analysis

Learning Outcomes

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

- Identify stiff and Hamiltonian differential equations
- Analyze geometric and stability properties of differential equations
- Choose an appropriate method for the solution of stiff or Hamiltonian differential equations
- Analyze geometric and stability properties of numerical methods
- Implement numerical methods for solving stiff or Hamiltonian differential equations

Teaching methods

Ex cathedra lecture, exercises in classroom

Assessment methods

Written

Supervision

Office hours	Yes
Assistants	Yes

Resources

Bibliography

E. Hairer ans G. Wanner, "Solving Ordinary Differential Equations II", second revised edition, Springer, Berlin, 1996
E. Hairer, C Lubich and G. Wanner, "Geometric Numerical Integration", second edition, Springer, Berlin, 2006

Ressources en bibliothèque

- Solving Ordinary Differential Equations II / Hairer
- Geometric Numerical Integration / Hairer

Websites

- http://anmc.epfl.ch/Numerical.html