EPFL

MATH-325 | **Dynamics and bifurcation**

Vela Arevalo Luz Vianey

Cursus	Sem.	Type
Mathematics	BA6	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

Introduction to local and global behavior of nonlinear dynamical systems arising from maps and ordinary differential equations. Theoretical and computational aspects studied.

Content

One dimensional flows
Elementary bifurcations
One dimensional maps
Systems of ordinary differential equations: planar systems and phase portraits, non linear systems, Lyapunov stability, mechanical systems, La-Salle invariance principle, index in two dimensional vector fields, periodic orbits and limit cycles, Poincaré-Andronov-Hopf bifurcation, structural stability.

Keywords

Systèmes dynamiques à temps discrets et à temps continu, discrete and continuous dynamical systems, elementary bifurcations: saddle-node, transcritical, hysteresis, pitchfork; Lyapunov stability, Poincaré maps, mechanical systems.

Learning Prerequisites

Required courses

Analyse I, Analyse II, Algebre linéaire

Recommended courses

Equations différentielles ordinaires

Learning Outcomes

By the end of the course, the student must be able to:
- Analyze dynamical systems in continue and discrete time
- Describe local and global behavior of differential equations and maps
- Work out / Determine stability properties as a function of one or more parameters

Transversal skills

- Communicate effectively, being understood, including across different languages and cultures.
- Communicate effectively with professionals from other disciplines.

• Use a work methodology appropriate to the task.

Teaching methods
Lectures 2 hours a week and exercise sessions 2 hours a week.

Expected student activities
Attendance to lectures, attendance to exercise sessions, solution of homework problems that may involve theoretical or numerical solutions, give a final exam.

Assessment methods
Final exam.
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	No
Assistants	Yes
Forum	Yes

Resources

Bibliography
Introduction to Dynamical Systems: continuous and discrete, by Clark Robinson, 2012.
Dynamics and bifurcations, by J. Hale and H. Kocak, 1991.

Ressources en bibliothèque
• Introduction to Dynamical Systems: continuous and discrete / Robinson
• (electronic version)
• Dynamics and bifurcations / Hale & Kocak

Notes/Handbook
Lecture notes will be given, to be completed by the students.

Websites
• http://moodle.epfl.ch