**EPFL**

| MATH-325 | **Dynamics and bifurcation** |
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| | 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

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|---|---|
| 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
• Dynamics and bifurcations / Hale & Kocak
• (electronic version)

### Notes/Handbook

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

### Websites

• http://moodle.epfl.ch