

Analysis of (networks of) nonlinear oscillators

Number of hours: 20

Credits: 5

AIMS AND CONTENT

Learning Outcomes

This course aims to provide the students with mathematical and numerical tools for analyzing nonlinear dynamical systems, even networked, with either fixed or changing parameters (in the latter case the lessons' topic will be the so-called bifurcation analysis). In particular, the lessons will focus on geometrical methods for qualitative analysis and the most diffused numerical methods for quantitative analysis. The main theoretical results will be applied to dynamical systems from different fields and illustrated through computer demos in the MATLAB programming environment.

Syllabus/Content

1. Introduction to nonlinear dynamical systems (both continuous-time and discrete-time)
2. Phase portraits, invariant sets and stability
3. Geometrical method
4. State space, parameter space and control space
5. Bifurcations
6. Networks of nonlinear dynamical systems
7. Master Stability Function
8. Numerical analysis methods

WHO

Teacher(s):

Name: Matteo Lodi

Name: Marco Storace

Registration: by e-mail to marco.storace@unige.it

How

Teaching Methods:

The topics of the course are presented and illustrated through examples during frontal lectures, which mainly consist of:

- PowerPoint or pdf presentations
- teacher-led demonstrations and presentation of examples on the blackboard
- use of simulation tools (Matlab)

Exam Description:

Oral examination focused on analyzing a specific nonlinear dynamical system (chosen by the student and approved by the teachers), using the analytical and numerical tools introduced during the lectures.

Assessment Methods:

The assessment will be based on:

-) communication skills
-) knowledge and comprehension of the subject topics
-) ability to draw connections among ideas
-) ability to analyze (networks of) nonlinear dynamical systems

WHERE AND WHEN

Lesson Location

via Opera Pia 11A (DITEN), room D3 (“Aula conferenze”, ground floor).

Lesson Schedule

21/01 9.30-12

23/01 9.30-12

28/01 9.30-12

30/01 9.30-12

3/02 9.30-12

5/02 9.30-12

10/02 9.30-12

12/02 9.30-12