Course denomination: ANALYSIS OF (NETWORKS OF) NONLINEAR OSCILLATORS

Teachers: Matteo Lodi and Marco Storace

Course specific educational goals: This course aims to provide the students with mathematical and numerical tools for the analysis of 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 be focused on both geometrical methods for qualitative analysis and the most diffused numerical methods for quantitative analysis. The main theoretical results will be applied to dynamical systems arising from different fields and will be illustrated through computer demos in the MATLAB programming environment.

Lecture hours: 20.

Course essential contents:
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

Timetable:

24 **January** - 2.5h - (9.30 - 12)
26 **January** - 2.5h - (9.30 - 12)
31 **January** - 2.5h - (9.30 - 12)
3 **February** - 2.5h - (9.30 - 12)
6 **February** - 2.5h - (9.30 - 12)
8 **February** – 2.5h - (9.30 - 12)
13 **February** - 2.5h - (9.30 - 12)
15 **February** - 2.5h - (9.30 - 12)

Classroom: via Opera Pia 11 (DITEN), room D2 (ground floor).

Course language: Italian (default) or English (upon request).

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

Bibliography and reference textbooks:

-) Material provided by the lecturer (main reference textbook, in Italian)
-) S.H. Strogatz, Nonlinear dynamics and chaos, Addison-Wesley, 1994.
-) Y.A. Kuznetsov, Elements of Applied Bifurcation Theory, Springer-Verlag, 1998.
-) M. Parodi, M. Storace, Linear and Nonlinear Circuits: Basic and Advanced Concepts, Vol. 2, Springer, 2020.