UCLouvain

linma2361

2020

Nonlinear dynamical systems

Due to the COVID-19 crisis, the information below is subject to change, in particular that concerning the teaching mode (presential, distance or in a comodal or hybrid format).

5 credits	30.0 h + 22.5 h	Q1

Teacher(s)	Absil Pierre-Antoine ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	The course is an introduction to the analysis and synthesis of nonlinear dynamical systems. The mathematical tools are illustrated on different applications, preferentially in the fields of neurodynamics, nonlinear control, and physics. Further specific illustrations are presented by the students at the end of the course.
Aims	Contribution of the course to the program objectives : • AA1.1, AA1.2, AA1.3 • AA5.5, AA5.6 At the end of the course, the student will be able to: 1 • Make adequate use of basic mathematical tools to model, analyze, and design nonlinear dynamical systems, in areas such as neurodynamics, nonlinear control, and physics. Transversal learning outcomes : • Use a reference book in English; • Discuss and criticize research articles ; • Report in writing and present the results orally. - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** • Homeworks, exercices, or laboratory work during the course semester • Written report and oral presentation of a project, including a bibliographical part (article or book chapter reading) and computer illustrations of the theory. Precisions are given in the course outline (plan de cours) available on iCampus > LINMA2361 > Documents et liens
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** • Lectures. • Homeworks, exercices, or laboratory work to be carried out individually or in small groups.
Content	• Introduction to nonlinear phenomena • Multiple equilibrium points and systems in the plane • Lyapunov functions, gradient systems, stability • Limit cycles • Hopf bifurcations, asymptotic methods • Introduction to chaos Depending on the choice of the course book, some of the following themes may also be touched : • Introduction to dynamical models in neuroscience • Simple neural computation models, Hopfield networks • Stabilization of equilibrium points • Coupled oscillators, synchronization phenomena, and collective motions • Input-output tools for nonlinear system analysis
Inline resources	http://moodleucl.uclouvain.be/course/view.php?id=8235

Bibliography	• Ouvrage de références • Documents complémentaires disponibles sur Moodle Des précisions sont fournies dans le plan de cours disponible sur Moodle.
Faculty or entity in charge	MAP

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Electro-mechanical Engineering	ELME2M	5		
Master [120] in Mathematical Engineering	MAP2M	5		
Master [120] in Physics	PHYS2M	5		
Master [120] in Biomedical Engineering	GBIO2M	5		