UCL Université catholique de Louvain

LINMA2361

2012-2013

Nonlinear systems

5.0 credits	30.0 h + 22.5 h	1q

Teacher(s) :	Absil Pierre-Antoine ;
Language :	Français
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 :	An increasing number of engineering applications either exploit or have to deal with nonlinear dynamical phenomena. The course presents the basic mathematical tools used in the modelling and analysis of such phenomena. *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".*
Content :	-- Introduction to nonlinear dynamical phenomena -- Introduction to dynamical models in neuroscience -- Multiple equilibria and planar models -- Simple models of neural computation, Hopfield networks -- Gradient systems, Lyapunov functions, stability -- Feedback stabilization of equilibria -- Limit cycles -- Hopf bifuractions, asymptotic methods -- Coupled oscillators, synchronization phenomena -- Input-output tools for the analysis of nonlinear systems -- Introduction to chaos and strange attractors
Other infos :	Information about the course and a copy of the slides are available at http://sites.uclouvain.be/absil/INMA2361/inma2361_projet.htm References : "Nonlinear Dynamics and Chaos", S. Strogatz, Perseus Books Publishing, 1994. "Spikes, decisions, and actions. Dynamical foundations of neuroscience", H.R. Wilson, Oxford University Press, 1999. "Nonlinear Oscillations, Dynamical Systems, and Bifurcation of Vector Fields", Guckenheimer, Holmes, Springer-Verlag, 1983. "Introduction to the theory of neural computation", J. Hertz, A. Krogh, R. Palmer. Evaluation : - A final project by groups of two students. The project includes bibliographical research, computer simulations, and an oral presentation. - A few homeworks during the academic year
Cycle and year of study :	> Master [120] in Biomedical Engineering > Master [120] in Electro-mechanical Engineering > Master [120] in Mathematical Engineering > Master [120] in Physics
Faculty or entity in charge:	MAP