LINMA2875

2016-2017

System Identification

5.0 credits	30.0 h + 30.0 h	2q

Teacher(s) :	Hendrickx Julien ;
Language :	Anglais
Place of the course	Louvain-la-Neuve
Inline resources:	> http://icampus.uclouvain.be/claroline/course/index.php?cid=INMA2875
Prerequisites :	-- LINMA 1510 (Automatic control) OR LINMA 2300 (Control of processes) OR equivalent -- Having attended a class on stochastic processes (as LINMA 1731) helps, but is not a prerequisite.
Main themes :	This class is an introduction to system identification, which consists in finding an appropriate representation of a dynamical system using appropriate measurements. It will cover some of the main parametric and nonparametric methods for identifying dynamical systems, including in closed loop. It will also cover the properties of signals and model classes that are relevant for system identification. A realistic identification project will give students the opportunity to apply and implement the techniques that they will have learned.
Aims :	With respect to the L.O. framework, this class contributes to the developpement of the following learning outcomes -- AA1.1, AA1.2, AA1.3 -- AA2.1, AA2.4 -- AA3.2 -- AA5.3, AA5.5 More precisely, by the end of the class, the student will be able to : -- recognize a problem of system identificaiton -- propose and implement solutions to simple identification problems -- identify a dynamical systems using input-output data -- validate a model of system that has been identified, and compare different simple models -- design an experiment to identify a simple system -- develop a deeper understanding of system identification by him/herself if necessary in order to solve more complex problems Transversal learning outcomes : -- Handling unforeseen technical issues that appear when treating a real-world problem -- Making reasonable hypothesis for a given problem, and evaluating them a posteriori -- Taking part to a technical class in English *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 :	-- Exam at the end of the year. -- Identification of a system on the basis of real input/output data (using the Matlab System Identification Toolbox, developed by L. Ljung). -- Problem sets during the year.

Teaching methods :	-- Regular lectures. -- Resolutions of simple problems under the supervison of teaching assistant in order to get familiar with new concepts. -- Problem sets to be solved in small group in order to develop a deeper understanding of the concepts. -- A complete project of system identification in realistic conditions.
Content :	The following topics will be covered -- Nonparametric methods: temporal analysis, frequential analysis, including Fourier and spectral analysis -- Main classes of LTI systems and their properties, including the notions of identifiability and predictors -- Certain parametric methods: linear regression, instrumental variables, prediction errors, and some statistical methods including the maximum likelihood method -- The properties of (input) signal, including the notion of information content of the signals and the level of persistence of excitation. -- The convergence of the method seen -- Identification techniques for systems controlled in closed loop
Bibliography :	Lecture notes are available on icampus. In additon, two possible relevant reference books are : -- « System Identification », Torsten Söderström and Petre Stoica http://user.it.uu.se/~ts/sysidbook.pdf -- « System Identification - Theory for the user », Lennart Ljung, Prentice Hall, 1999.
Other infos :	The lectures and problem sessions are in English, and all documents are in English. Homework, exams, and project reports can be written in English or French. The organisation details are specified on iCampus.
Faculty or entity in charge:	MAP

Programmes / formations proposant cette unité d'enseignement (UE)

Intitulé du programme	Sigle	Credits	Prerequis	Acquis d'apprentissage
Master [120] in Electrical Engineering	ELEC2M	5	-	🔍
Master [120] in Biomedical Engineering	GBIO2M	5	-	🔍
Master [120] in Electro-mechanical Engineering	ELME2M	5	-	🔍
Master [120] in Mechanical Engineering	MECA2M	5	-	🔍
Master [120] in Mathematical Engineering	MAP2M	5	-	🔍