UCLouvain

linma2875

2019

System Identification

In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.

5 credits	30.0 h + 30.0 h	Q2

Teacher(s)	Hendrickx Julien ;
Language :	English
Place of the course	Louvain-la-Neuve
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 : 1 • 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	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** • 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	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** • 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
Inline resources	http://icampus.uclouvain.be/claroline/course/index.php?cid=INMA2875
Bibliography	Le cours s'appuie sur un syllabus disponible sur icampus Des livres de références sont également proposés : 1. L. Ljung System Identification - Theory for the user Prentice Hall, 1999. (disponible en bibliothèque) 2. T. Soderstorm and P Stoica, System Identification (http://user.it.uu.se/~ts/sysidbook.pdf)
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 containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Data Science Engineering	DATE2M	5		
Master [120] in Biomedical Engineering	GBIO2M	5		
Master [120] in Mechanical Engineering	MECA2M	5		
Master [120] in Mathematical Engineering	MAP2M	5		
Master [120] in Electro-mechanical Engineering	ELME2M	5		
Master [120] in Electrical Engineering	ELEC2M	5		
Master [120] in Data Science: Information Technology	DATI2M	5		