UCLouvain

linma2300 — Analysis and control of distributed parameter systems

2019

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	Q1

Teacher(s)	Dochain Denis ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	The content of this course deals with the control of linear time invariant systems. In particular the notions of dynamical models and feedback loop will be considered. The notion of operator (implicitly connected to Laplace transform) will be used to transform differential equations into algebraic equations in order to introduce the concept of transfer functions that will ease the analysis and synthesis of controllers and closed-loop systems. The course will mainly concentrate on PID (proportional-integral-derivative) controllers, with reference to the IMC (internal model control) approach which is largely used in process control. The course will also consider topics like time-delay compensation, feedforward actions, ratio control and cascade control, and is open to topics like inferential control and state observers. The course is based in particular on the notions of mass and energy balances and of unit operations, and it is illustrated by examples drawn from applications in the process industry.
Aims	With respect to the referentiel AA, this courses contributes to the dvelopment, the acquisition and the evaluation of the following learning outcomes : • AA1.1, AA1.2, AA1.3 • AA5.3, AA5.4, AA5.5 1 At the end of this course, the student will be able : • to define a control problem poser; • to define the important variables related to the control problem; • to derive the mathematical model suited to the design of the controller; • to analyzer the control problem; • to select and synthesize an appropriate control strategy; • to evaluate the performance of the selected control strategy - - - - *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.** Laboratory evaluation outside of the exam period and exercise-based written exam.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** The course consists of ex-cathedra courses and of pracical exercices aimed at implementing the concepts of the course in particular via computer exercices using Matlab and Simulink as well as two laboratories aimed at implementing the basic concepts (dynamics and PID regulation) of the course on a tank level control system. The presence at the laboratories are mandatory ; the registration is done via a piece of paper posted at the level -1 of the Euler building . Both laboratories will the object of an individual evaluation performed during the last week of the semester. Three homeworks are proposed during the semester. These are individual works proposing the solution of exercices illustrating the matter of the course. These have to be hand-written. Typically two weks are given before the delivery of the homeworks. The homeworks are mandatory. Any delay in the delivery of homeworks will generate a note of 0/20.
Content	1. General concepts of control 2. Notions of dynamical balances 3. Mathematical models of dynamical systems 4. Stability 5. Steady-state acurracy 6. Disturbance rejection and trajectory tracking 7. Robustness 8. Control structures

	9. Case studies, in particular from the process industry
Inline resources	https://moodleucl.uclouvain.be/course/view.php?id=7426
Bibliography	Manuel : notes de cours, notice de laboratoire et énoncés des séances d'exercices (disponibles sur icampus).
Faculty or entity in charge	MAP

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Biomedical Engineering	GBIO2M	5		
Master [120] in Mathematical Engineering	MAP2M	5		
Master [120] in Electro-mechanical Engineering	ELME2M	5		
Master [120] in Chemical and Materials Engineering	KIMA2M	5		