UCLouvain

linma2300

2022

Analysis and control of distributed parameter systems

5.00 credits	30.0 h + 30.0 h	Q1

This learning unit is not being organized during this academic year.

Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	A signals and systems course, such as LEPL1106. A linear control course, such as LINMA1510.
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.
Learning outcomes	**At the end of this learning unit, the student is able to :** 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
Evaluation methods	Possible laboratory evaluation outside of the exam period and report of maximum 25 pages on one application related to the scope of the course and covering different aspects of the course matter.
Teaching methods	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, articles scientifiques de référence et (parties d')ouvrages de référence (disponibles sur moodle).
Faculty or entity in charge	MAP

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Chemical and Materials Engineering	KIMA2M	5		
Master [120] in Biomedical Engineering	GBIO2M	5		
Master [120] in Electro-mechanical Engineering	ELME2M	5		
Master [120] in Mathematical Engineering	MAP2M	5		