UCLouvain

linma1510

2021

Linear Control

5.00 credits	30.0 h + 30.0 h	Q1

Teacher(s)	Dochain Denis ;
Language :	English
Place of the course	Louvain-la-Neuve
Prerequisites	Notions of signals and systems as taught in LEPL1106.
Main themes	Development of mathematical models for linear dynamical systems (state-space representation, transfer functions) allowing to represent the dynamics in a unified way for a diversity of engineering applications (e.g. electromechanical, mechanical, electrical, chemical, biological, computer science) Design of control schemes that meet specifications related to stability, transient and steady state performance (accuracy), and robustness. PI and PID controllers, Linear Quadratic Control, Smith predictor, feedforward control, cascade control. Use of software to design controllers.
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 development, the acquisition and the evaluation of the following learning outcomes :** • AA1.1, AA1.2, AA1.3 • AA5.3, AA5.4, AA5.5 **At the end of the course, the student will be able :** 1 1. Design control systems based on linear models; 2. Design of control schemes that meet specifications on related to stability, transient and steady state performance (accuracy), and robustness. PI and PID regulators, Linear Quadratic Control, Smith predictors, feedforward control, cascade control; 3. Use software to design controllers.; 4. Implement closed-loop control system in laboratory experiments under conditions similar to those in industrial applications.; 5. Use industrial PID controller; 6. Autonomously run automatic control experiments, from the design level to the actual implementation and performance evaluations;
Evaluation methods	Laboratory evaluation outside of the exam period and written exam, either under the format of an oral evaluation or via the use of an evaluation software for the laboratory evluation, either under an hand-written mode or via the use of an evaltaion software for the written exam. The teacher reserve the right to examine orally any student besides the laboratory evaluation and the written exam.
Teaching methods	Problem-based learning, laboratory experiments. The course will be given either in presence mode or in distance mode.
Content	1. Mathematical Models 2. General principles of closed-loop systems and control 3. Stability 4. Steady state accuracy 5. Disturbance rejection 6. Performance in transient regime 7. Robustness 8. Controller structures and anti-windup 9. Case studies: electrical systems, mechanical systems, automobile, aeronautics, thermal and nuclear powerplants, heat exchanger, industrial grinding and mixing processes, (bio)chemical processes, distillation columns, biomedical applications, electronics and telecommunication, etc.
Inline resources	https://moodleucl.uclouvain.be/course/view.php?id=7834
Bibliography	Transparents de théorie, notices de laboratoire et d'exercices, fiches, fichiers d'exemples et d'llustration des concepts. Livre de référence : K. Astrom & R. Murray, Feedback Systems: An Introduction for Scientists and Engineers http://www.cds.caltech.edu/~murray/amwiki/index.php

Faculty or entity in charge	MAP

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Mechanical Engineering	MECA2M	5		
Master [120] in Chemical and Materials Engineering	KIMA2M	5		
Master [120] in Electrical Engineering	ELEC2M	5		
Minor in Engineering Sciences: Applied Mathematics (only available for reenrolment)	MINMAP	5		
Master [120] in Electro-mechanical Engineering	ELME2M	5		
Specialization track in Biomedical Engineering	FILGBIO	5		
Minor in Applied Mathematics	LMINOMAP	5		
Specialization track in Applied Mathematics	FILMAP	5		