UCLouvain

linma2300 *2025*	Analysis and control of distributed parameter systems

The version you're consulting is not final. This course description may change. The final version will be published on 1st June.

5.00 credits	30.0 h + 30.0 h	Q1

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	• Work carried out during the term: homework, exercises, mini-projects or practical work. These activities are therefore only organised (and assessed) once per academic year. • Written or oral examination, depending on the circumstances. The final mark is (3/10) T + (7/10) E, where T is the mark for the work carried out during the semester and E is the mark for the examination. Further information is available on Moodle.
Teaching methods	• Lectures • Assignments, exercises or practical work under the supervision of assistants
Content	The following elements will be integrated into the course content, dedicated to high-dimensional data analysis and optimization, with variations from one year to the next depending on the teaching team : • inverse problem solving, regularisation by sparse and low-rank models, and applications • analysis and processing of high-dimensional data, or data available in large quantities • sketching' approaches, random projections, randomised principal component analysis • the Nystrom method, and high-dimensional linear algebra • derivative-free optimisation or optimisation on differential manifolds • deep learning, stochastic gradient descent, and the Adam method.
Inline resources	• Course Moodle webpage
Bibliography	slides et notes de cours fournis sur Moodle. | slides and lecture notes provided on Moodle.

Other infos	Having taken, or taking the following courses during the same semester, is desirable for this course: • LINMA2380 Matrix computations • LINMA2471 Optimization models and methods II
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 Energy Engineering	NRGY2M	5		