Optimization-based Control Design

Lecturer
Emanuele GARONE (Coordinator)

Course mnemonic
ELEC-H509

ECTS credits
4 credits

Language(s) of instruction
English

Course period
First term

Course content

Complements on linear system theory; Dynamic programming; Design and properties of linear quadratic control; Kalman filter; LQG control; LMIs in Control, Optimal Multiobjective Control, Model Predictive Control

Objectives (and/or specific learning outcomes)

To introduce the general tools used in optimal control theory and to detail several uses of convex optimization tools (such as LMIs) in control. To give some details on some important Model Predictive Control schemes

Teaching method and learning activities

The lectures alternate with exercises on paper, computer simulations and real-time controller implementation.

Contribution to the teaching profile

This teaching unit contributes to the following competences:

- In-depth knowledge and understanding of exact sciences with the specificity of their application to engineering
- In-depth knowledge and understanding of integrated structural design methods in the framework of a global design strategy
- In-depth knowledge and understanding of the advanced methods and theories to schematize and model complex problems or processes
- Reformulate complex engineering problems in order to solve them (simplifying assumptions, reducing complexity)
- Present and defend results in a scientifically sound way, using contemporary communication tools, for a national as well as for an international professional or lay audience
- Develop, plan, execute and manage engineering projects at the level of a starting professional
- A creative, problem-solving, result-driven and evidence-based attitude, aiming at innovation and applicability in industry and society
- A critical attitude towards one's own results and those of others
- Consciousness of the ethical, social, environmental and economic context of his/her work and strives for sustainable solutions to engineering problems including safety and quality assurance aspects
- An attitude of life-long learning as needed for the future development of his/her career
- Has a profound knowledge of either (i) nano- and opto-electronics and embedded systems, (ii) information and communication technology systems or (iii) measuring, modelling and control.
- Has a broad overview of the role of electronics, informatics and telecommunications in industry, business and society.
- Is able to analyse, specify, design, implement, test and evaluate individual electronic devices, components and algorithms, for signal-processing, communication and complex systems.
- Is able to model, simulate, measure and control electronic components and physical phenomena.
- Is aware of and critical about the impact of electronics, information and communication technology on society.

References, bibliography and recommended reading

- A.E. Bryson et Yu-Chi Ho (1975) Applied Optimal Control. Hemisphere Publishing Corporation. - T. Kailath (1980) Linear Systems, Prentice-Hall, Englewood Cliffs. - H. Kwakernaak and R. Sivan (1972) Linear Optimal Control Systems. Wiley-Interscience. - M. Green and D.J.H. Limebeer (1995) Linear Robust Control, Prentice-Hall, Englewood-Cliffs.

Other information

Contact(s)

Service d'Automatique et d'Analyse des Systèmes Bât. L, porte E, 1er étage Mail : egarone@ulb.ac.be

Evaluation method(s)

Other

Evaluation method(s) (additional information)

Oral examination + Project

Determination of the mark (including the weighting of partial marks)

30% Project, 70% Theory

Main language(s) of evaluation

English

Programmes

Programmes proposing this course at the Brussels School of Engineering

MA-IREL | Master of science in Electrical Engineering | finalité electronics and information technologies/unit 2 and
MA-IREM | Master of science in Electromechanical Engineering | finalité Professional/unit 2