Automatique

Lecturer
Michel KINNAERT (Coordinator)

Course mnemonic
MATH-H304

ECTS credits
5 credits

Language(s) of instruction
French

Course period
Second term

Course content

Introduction and motivation

Part I: Modelling of dynamic systems

- Dynamic model: refresher, linearization, introduction to state space models
- Sudy of the state space models
- Analysis of the model of a LTI system: characterization of the time resonse, link with the pole positions
- Modelling from experimental data

Part 2: Foundations of control loops

- Analysis of the properties of a closed-loop
- Basic notions on PID control

Part 3: Controller design

- Root locus method
- Methods based on the harmonic response
- Introduction to digital control

Objectives (and/or specific learning outcomes)

The objective is to teach the foundation of control engineering.

At the end of the course, the student will be able

- to determine and use different types of modesl for singlle-input-single-output linear time invariant dynamic systems (transfer function, state space model)
- to analyse the preperties of linear time invariant (LTI) dynamic systems (stability, controllability, observability)
- to synthesize a classicla controller (P, PI, PID, lead or lag controlller) be exploiting the root locus method and/or methods based on the harmonic response (Bode and Nyquist curves)

Pre-requisits and co-requisits

Pre-requisites courses

MATH-H2000 | Analyse II | 8 crédits

Co-requisites courses

MECA-H3001 | Fluid mechanics and transfer processes | 5 crédits

Teaching method and learning activities

- Lectures based on slides and numerous examples detailed on the blackboard
- Practical work

Contribution to the teaching profile

This teaching unit contributes to the following competences:

- Abstraire, modéliser et simuler des systèmes physiques complexes rencontrés dans les applications biomédicales (bioélectricité, biomécanique, écoulements, etc.)
- Se représenter les mécanismes biologiques fondamentaux depuis la biochimie de la cellule jusqu'au fonctionnement des principaux systèmes de la physiologie humaine

References, bibliography and recommended reading

G.F. Franklin, J.D. Powell and A. Emami-Naeini. Feedback Control of Dynamic Systems. 7th edition, Peasron, 2015

K. Ogata. ModernControl Engineering, 5th edition, Prentice Hall, 2010.

Evaluation method(s)

Other

Evaluation method(s) (additional information)

Practical work: evlautaion of the reports and student activity

1st sessions: Written and oral exams

2nd session: written examn only

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

First session: practical work 20%, written exam 40%, oral exam 40%

Second session: practical work 20%, written exam 80%

Main language(s) of evaluation

French

Programmes

Programmes proposing this course at the Brussels School of Engineering

BA-IRCI | Bachelor in Engineering Sciences | option Bruxelles/ unit 3, MA-IRBC | Master in Chemistry and Bio-industries Bioengineering | finalité Professional/unit 1 and MA-IRBE | Master in Environmental Bioengineering | finalité Professional/unit 1

Programmes proposing this course at the faculty of Sciences

MA-IRBC | Master in Chemistry and Bio-industries Bioengineering | finalité Professional/unit 1 and MA-IRBE | Master in Environmental Bioengineering | finalité Professional/unit 1