ME-321

Control systems + TP

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Cursus	Sem.	Type
Electrical and Electronical Engineering	BA5	Obl.
HES - EL	H	Opt.
Mechanical engineering minor	H	Opt.
Mechanical engineering	BA5	Obl.
Space Technologies minor	H	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	3 weekly
Project	1 weekly
Number of positions	

Summary

Provides the students with basic notions and tools for the analysis and control of dynamic systems. Shows them how to design controllers and analyze the performance of controlled systems.

Content

- Introduction to automatic control
- Closed-loop transfer functions
- Analysis of dynamic systems
- Design and analysis of PID controllers
- Loop shaping controller design
- State space analysis and control design
- Introduction to digital implementation

Keywords

Analysis and design of control systems, stability, PID control, loop shaping, state space control

Learning Prerequisites

Required courses

- Real analysis
- Complex analysis
- Physics
- Signals and systems

Important concepts to start the course

- Represent a physical process as a system with its inputs, outputs and disturbances and derive its dynamic equations, A1
- Represent a linear system by a transfer function

Learning Outcomes

By the end of the course, the student must be able to:

- Analyze a linear dynamical system (both time and frequency responses), A3
- Construct and analyse a discrete-time model for a dynamic system, A5
- Design a PID controller, A7
- Design a simple controller for a dynamic system, A8
- Assess / Evaluate the stability, performance and robustness of a closed-loop system, A12
- Define (specifications) the adequate control performance for dynamic systems, A13
- Propose several control solutions, formulate the trade-offs, choose the options, A14

Transversal skills

- Set objectives and design an action plan to reach those objectives.
- Use both general and domain specific IT resources and tools
- Communicate effectively with professionals from other disciplines.
- Access and evaluate appropriate sources of information.

Teaching methods

Lectures, written exercices, computer-based exercises and MOOC-based laboratory sessions

Expected student activities

- Participate to lectures, exercices and laboratory sessions
- Homework of about 2 hours per week

Assessment methods

Written exam

Supervision

Office hours	No
Assistant.e.s	Yes
Forum	No
Others	• Supervised written exercise sessions • Supervised MOOC laboratory sessions • Supervised hands-on computer sessions

Resources

Bibliography

Franklin, Powell and Emami-Naeini, "Feedback Control of Dynamic Systems, 7th Edition". Pearson publishing.

Ressources en bibliothèque

- Find the reference at the Library

Notes/Handbook

Slides / notes available online.

Moodle Link

- https://go.epfl.ch/ME-321

Prerequisite for

- Multivariables Systems
- Advanced Control Systems
- Non-linear Control
- Model Predictive Control
- Identification of Dynamical Systems