

ME-321

Control systems + TP

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Cursus	Sem.	Type
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
TP	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
- Sampling and signal reconstruction
- Discrete-time systems. z-transform
- Closed-loop transfer functions
- Frequency response
- Stability
- PID control and loop shaping design

Keywords

Digital control, analysis and design of control systems, stability, PID 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, A1
- Derive the dynamic equations for the system, A2
- Represent a linear system by a transfer function, A5

Learning Outcomes

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

- Analyze a linear dynamical system (both time and frequency responses), A4
- Construct and analyse a discrete-time model for a dynamic system, A7
- Design a PID controller, A9
- Design a simple controller for a dynamic system, A10
- Assess the stability, performance and robustness of a closed-loop system, A14
- Define (specifications) the adequate control performance for dynamic systems, A15
- Propose several control solutions, formulate the trade-offs, choose the options, A16

Transversal skills

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

Teaching methods

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

Expected student activities

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

Assessment methods

Written exam

Supervision

Office hours	No
Assistants	Yes
Forum	No
Others	<ul style="list-style-type: none"> • Supervised written exercise sessions • Supervised MOOC laboratory sessions • Supervised hands-on computer sessions

Resources

Bibliography

- R. Longchamp, *Commande numérique de systèmes dynamiques - Cours d'automatique : Volume 1, Méthodes de base*, Presses Polytechniques et Universitaires Romandes troisième édition, 2010.

Ressources en bibliothèque

- [Commande numérique de systèmes dynamiques / Longchamp](#)

Notes/Handbook

Slides / notes available online.

Websites

- <http://la.epfl.ch/teaching>

Moodle Link

- <http://moodle.epfl.ch/course/view.php?id=13758>

Prerequisite for

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