ME-221

Dynamical systems

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Cursus	Sem.	Type
Mechanical engineering	BA4	Obl.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	3 weekly
Exercises	1 weekly
Number of positions	

Summary

Provides the students with basic notions and tools for the analysis of dynamic systems. Shows them how to develop mathematical models of dynamic systems and perform analysis in time and frequency domains.

Content

- Dynamic behavior of physical systems with electrical, mechanical, electromechanical, fluid, and thermal components. Concept of process, system, and model.
- Linearization procedure. Convolution. State-space representation.
- Laplace transformation. Concept of transfer function. Poles and zeros.
- Transient and frequency response of linear dynamical systems. Bode and Nyquist plots.

Keywords

Mathematical modeling, transfer function, time and frequency domain analysis

Learning Prerequisites

Required courses

- Analysis I-III
- General Physics I and II

Learning Outcomes

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

- Represent a physical process as a system with its inputs, outputs, and disturbances, A1
- Analyze a linear dynamical system (both time and frequency response), A3
- Represent a system by a transfer function and by a linear or nonlinear state-space model, A4
- Construct a linear model of a nonlinear system, A2

Transversal skills

- Manage priorities.

- Assess one's own level of skill acquisition, and plan their on-going learning goals.
- Access and evaluate appropriate sources of information.
- Use both general and domain specific IT resources and tools
- Plan and carry out activities in a way which makes optimal use of available time and other resources.

Teaching methods

Lectures, written exercices, and computer-based exercises

Expected student activities

- Participate to lectures and exercice sessions
- Work on exercises
- MATLAB assignments

Assessment methods

Written Exam

Supervision

Office hours	No
Assistant.e.s	Yes
Forum	Yes

Resources

Bibliography

- System Dynamics, 4th Edition by K. Ogata, Prentice Hall, 2004
- System Dynamics, 3rd Edition by W. Palm, McGraw-Hill College, 2013

Ressources en bibliothèque

- Retrouver les références à la Bibliothèque

Moodle Link

- https://go.epfl.ch/ME-221

Prerequisite for

- Control systems (ME-321)
- Mechanical vibrations (ME-332)
- Multivariable systems (ME-324)
- Measurement techniques (ME-301)
- Dynamical effects in mechanical design (ME-311)