

Mathematical Simulation Models

Subject area: Mechanical Engineering

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| University: | CTU |
| Level: | MA1, MA2, MA all years |
| Teaching mode: | hybrid: some students participate online, other students attend real-life |
| Instructor(s): | Vyhlídal Tomáš, Bušek Jaroslav, Simeunovič Goran, Yuksel Can |

Short description

Automatic controllers are important part of many industrial processes and technologies. The goal of this course is to introduce students into basic knowledge of automatic control theory and practice like transfer functions, open versus closed loop control, design of controllers and frequency based analysis of control systems. The course also concentrates on logic control and control via programmable logic controllers.

Full description

A) Laplace and Z transform

1. The basic properties of the Laplace transforms
2. L transform solution of Cauchy problem in differential equations, inverse L transform
3. Convolution integral transform and transfer function models
4. Fourier transform, Bode diagram of the linear model
5. The basic properties of the Z transform
6. Sampled data linear system, discrete transfer function
7. Z transform solution of the difference equation, inverse Z transform

B) State space model of dynamic system

10. The state space notion, state variables, state trajectory
11. Introduction methods of state variables, state equations
12. Steady state of the system, static characteristics, types of singular points
13. Characteristic function of the linear dynamic system, stability notion

C) Computer model

15. Methods of numerical solution of the state space equation
16. Sampling time assessment, stability of the numerical method
17. Explicit and implicit methods, predictor-corrector

Learning outcomes

Control engineering methods, practical skills in computer-aided control design, simulations and visualizations

General information

Contact hours per week: 5
Total workload: 150 (in student hours for the whole course)
ECTS credits: 6
Language: English

Course start date: 19 September 2022

Course end date: 15 January 2023

Add. info about start date: Start course date refers to start of the semester at CTU. Schedules will be available 1-2 weeks before semester starts. Lectures are taken place from 19.9.2022 until 15.1.2023. Examination period from 16.1.2023 until 19.2.2023.

Weekly teaching day/time:

Time zone: CET (Denmark, Germany, France, Netherlands, Switzerland, Czech Republic)

Further information: Archive on recorded lectures will be available on MS-Teams

Prerequisites: Mathematics (matrices, differential equations, complex numbers, etc.), basic knowledge of control systems

Activities and methods: Lectures, Tutorial sessions

Presence on campus:

Final examination

Form: written and oral exam

Date:

Location/format:

Re-sit possibility:

Transcript available: end of semester

Add. info/requirements:

Registration

To register for this course, follow the registration requirements of your **home university** as specified here: www.euroteq.eu/courses-registration.

Administration

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| Number of places: | 20 |
| Minimum participants: | - |
| Internal course code: | E371097 |
| Contact: | jaroslav.busek@fs.cvut.cz |

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