Control Theory

Code: MK5IRAR6RX17-EN
ECTS Credit Points: 4
Evaluation: exam
Year, Semester: 1st year, 1st semester
Its prerequisite(s): -
Further courses are built on it: Yes/No
Number of teaching hours/week (lecture + practice): 2+2

Topics:

Mathematical description of systems in a continuous time and frequency domain: differential equations, status field description, Laplace transformation, transfer function. Description of system in a discrete time and frequency domain: discretization process, differential equations, discrete status model, Z-transformation, discrete differential equations. Mechanical, electrical, thermic and hydrodynamic foundation blocks modelling, transform non-linear equations to linear. Characters of feedback systems: verifying signs, suppression of trouble sign. Stability of linear systems in a time and frequency domain. Root and Locus (Root-Locus) method. Planning of feedback status systems. Digital regulation: discrete PID regulation, planning and tuning of parameters, in a discrete time and frequency domain. Stability in a discrete domain.

Literature:

Recommended:

- Dorf, R.C., Bishop, R.H., "Modern Control Systems", 12th edition, 2011, Pearson / Prentice Hall. ISBN-13:978-0-13-602458-3
- Robert H. Bishop, "Modern Control Systems with LabVIEW" 2012, NTS Press, ISBN-13: 978-1-934891-18-6
- Robert H. Bishop, ed. "The Mechatronics Handbook", 2nd ed, 2008, CRC Press

Schedule

1st week Registration week	
2nd week: **Lecture:** Mathematical descriptions of systems in continues time and frequency domain. Laplace transformation. **Practice:** Practice the description of linear and non-linear mechanical, electrical, hydraulics and thermic systems.	**3rd week:** **Lecture:** Description of systems in a discrete time and frequency domain. Z transformation. **Practice:** Practice the description of linear and non-linear mechanical, electrical, hydraulics and thermic systems.
4th week: **Lecture:** Modelling mechanical, electronical building blocks, making non-linear equations to linear. **Practice:** Computer modeling of mechanical and electronical building blocks.	**5th week:** **Lecture:** Modelling thermic and thermodynamic building blocks, make non-linear equations to linear. **Practice:** Computer modeling of thermic and thermodynamic building blocks.
6th week: **Lecture:** Characteristics of feedback	**7th week:** **Lecture:** Continuous examination of the

system: examiner signs, suppression of trouble signs, in a continuous time and frequency domain. **Practice:** Examination of feedback systems with computer simulation.	stability of feedback systems in a time and frequency domain. **Practice:** Stability examinations with computer simulations.
8th week: 1st drawing week	
9th week: **Lecture:** Description of state space and discrete time domain. **Practice:** Examination of state space with computer simulation.	**10th week:** **Lecture:** Status feedback in continues and discrete time domain. **Practice:** Examination of status feedback with computer simulation.
11th week: **Lecture:** Planning of feedback with status estimator in a time domain. **Practice:** Planning exercise of status feedback.	**12th week:** **Lecture:** Digital regulations I: discrete PID regulation theory. **Practice:** Discrete PID regulation implementation.
13th week: **Lecture:** Discrete PI, PD and PID regulation, determination of its parameters. **Practice:** Exercises with discrete PI, PD and PID regulations.	**14th week:** **Lecture:** Discrete PI, PD and PID theory of stability of the regulation circle. **Practice:** Discrete PI, PD and PID regulation exercises.
15th week: 2nd drawing week	

Requirements

A, for a signature:

Participation in practical classes, according to Rules and Regulations of University of Debrecen. The correct solution of the project and its submission before deadline.

B, for grade:

Oral exam in theoretical part.