

2.4.4 Control Systems

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| Control Systems |
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| Module Summary |
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| Module code: EEIB440 |
| Module coordinator: Prof. Dr. Frieder Keller |
| Credits (ECTS): 7 Points |
| Semester: 4. Semester |
| Pre-requisites with regard to content: Competencies acquired in modules Mathematics 1 + 2 +3, Circuit Analysis 1 + 2, Instrumentation and Measurement, Signals and Systems |
| Pre-requisites according to the examination regulations: Regarding to the examination regulations no pre-requisites are required |
| <p>Competencies:</p> <ul style="list-style-type: none"> • knowing about properties of semiconductor materials as well as the characteristics of diodes, bipolar- and field effect-transistors • knowing about the behavior of semiconductor devices a part of electronic circuits • representing diodes and transistors by equivalent circuit diagrams, • apply small-signal parameters to describe amplifier circuits, • partitioning complex circuits in acquainted basic circuits, • designing circuits for a given application by combination of basic circuits <p>to develop an advanced understanding of electronic semiconductor circuits. Participants will be able to describe and analyze control loops and to design basic controllers for a given purpose of application by</p> <ul style="list-style-type: none"> • knowing about basic terms and definitions in control theory • describing system dynamics in time- and frequency-domain • representing systems as block diagrams • modelling systems mathematically and identifying parameters • analyzing control loops regarding dynamics, accuracy and overshoot • designing controllers with commonly used methods • realizing analogue and digital controllers • designing multiloop control systems <p>to have a basic understanding of control engineering, to describe and analyze control systems mathematically, and to design and implement control loops. The associated lab deepens the theoretical knowledge by real-life, hands-on experiments.</p> |
| <p>Assessment:</p> <p>Exam, 120 minutes for the theoretical aspects. Practical skills are evaluated by colloquia during the lab experiments and a written report for each experiment.</p> |
| Usability: |

This module provides the basics of control theory and the foundation for advanced techniques in control engineering

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| Course: Control Systems |
| Module code: EEIB441 |
| Lecturer: Prof. Dr. Frieder Keller |
| Scope of weekly semester hours (SWS): 4 |
| Semester of delivery: Summer semester |
| Type/mode: Lecture, Compulsory subject |
| Language of instruction: English |
| Content: <ul style="list-style-type: none"> • Introduction: typical tasks and applications in control theory, history, basic terms and definitions, classification of systems, linear operations and modelling in block diagrams and corresponding transformations • LTI-Systems: Modelling in time and frequency domain, basic dynamic functional blocks • Modelling of processes and identification of parameters • Analysis of control loops regarding stability (Nyquist- and Routh-Hurwitz-criterion), accuracy, dynamics and robustness • Classical design methods: compensation, PID-controllers, root locus techniques • Windup phenomenon • Digital implementation of controllers |
| Recommended reading: <ul style="list-style-type: none"> • Nise, Norman S.: "Control systems engineering", John Wiley, 2000. • Ogata, Katsuhiko: "Modern Control Engineering", Prentice Hall • Tietze, Ulrich; Schenk, Christoph: Electronic Circuits, Springer Verlag • Föllinger, O.: Regelungstechnik: Einführung in die Methoden und ihre Anwendungen, 12. Auflage, VDE Verlag, Offenbach, 2016 • Hoffmann, J.; U. Brunner: MATLAB & Tools für die Simulation dynamischer Systeme, Addison-Wesley, München, 2002 • Mann, H.; H. Schiffelgen; R. Froriep: Einführung in die Regelungstechnik: Analoge und digitale Regelungen, Fuzzy-Regler, Regler-Realisierung, Software, 11. Auflage, Carl Hanser Verlag, München, 2009 |

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| Course: Control Systems Lab |
| Module code: EEIB442 |
| Lecturer: Prof. Dr. Frieder Keller |
| Scope of weekly semester hours (SWS): 2 |
| Semester of delivery: Summer semester |
| Type/mode: Labor, Compulsory subject |
| Language of instruction: English |

Content:

- Modelling and analysis of LTI-systems with MATLAB/Simulink
- Liquid level control
- Modelling, simulation and control of DC-servo-system
- Digital control of a magnetical levitation system
Operation if a ball-on-rim system

Recommended reading:

- Nise, Norman S.: “Control systems engineering”, John Wiley, 2000.
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