2.4.4 Control Systems

Control Systems

Module Summary
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
Competencies: • 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 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 • 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 regrading dynamics, accuracy and overshoot • designing controllers with commonly used methods • realizing analogue and digital controllers • designing multiloop control systems 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.
Assessment: Exam, 120 minutes for the theoretical aspects. Practical skills are evaluated by colloquia during the lab experiments and a written report for each experiment.
Usability:

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

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: • 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 implentation of controllers
Recommended reading: • 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

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
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