Module title: *Control Theory*

Module summary
Module code: SSTM140
Module coordinator: Prof. Dr. Daniel Braun
Credits (ECTS): 6
Semester: 1
Pre-requisites with regard to content: Strong foundation in mathematics and differential equations at university level (> 4 ECTS), basics of integral transformations and systems modelling, Electrical/Electromechanical engineering at university level (> 4 ECTS)
Pre-requisites according to the examination regulations: none
learning outcomes and competencies: With the successful completion of the module Control Theory, the student is able to perform system modelling tasks for single input/single output systems for gathering further insight into the system's static and dynamic behavior. The student is able to apply systems analysis tools for judging the systems stability and response to varying input signals. The student is enabled to choose an appropriate controller structure and apply methods for selecting and tuning the controller parameters to achieve a desired system behavior. The resulting controller can be designed as continuous time system as well as a discrete time system, methods for assessing the system properties in both domains are available to the student. The student is able to understand electronic circuits and to work with operational amplifiers. With this module the participants learn to use mathematical transformations, have an understanding of dynamic processes, can judge stability of systems and tune controller parameters. Students can design analogue and digital control systems and can create commercially-viable control applications.
Assessment: Lectures of the module share a joint written examination (duration 120 min) with mark + lab work (passed/not passed, 1 semester)

Course: Control
Module code:SSTM141
Lecturer: Prof. Dr. Daniel Braun
Contact hours: 4 SWS
Semester of delivery: yearly, summer
Type/mode: lecture
Language of instruction: English
Content: The lecture introduces the student to systems modelling and analysis as well as to the design of analog controllers:

- Process modelling, Laplace Transformation and Linearization
- Transfer Functions
- Stability and Basic Stability Criteria
- Frequency Response and Root Locus Analysis
- Control Loops and Control System Analysis
- Analog Controller Techniques and Control Loop Design
  Comparison of digital control and analog control systems
- Definition and properties of the z-transform, inverse z-transform
- stability of disrcete-time systems
- Deadbeat control algorithms
- PID control algorithms and transformation for analog to digital controllers
- Modelling and simulation of control loops
- Parameter Optimization with CA tools
- Basics of system identification

Recommended reading:

- Frederik, Dean / Chow, Joe H. - Feedback control problems using Matlab
- Nise, Norman S. - Control systems engineering – New York: Wiley 3rd Ed. 2000
- Lindner, Douglas - Introduction to signals and systems
- Zilouchian, Ali / Jamshidi, Mo - Intelligent control systems using soft computing methodologies
- Ogata, Katsuhiko – Discrete-Time Control Systems
- Nise, Norman S. - Control systems engineering – New York: Wiley 3rd Ed. 2000

Comments:

Course: Analogue Electronics Lab
Module code: SSTM142
Lecturer: Carlos Fernando Sánchez Ruiz
Contact hours: 2 SWS
Semester of delivery: yearly, summer
Type/mode: online lab
Language of instruction: English
Content: Experiments with Resistors, Capacitors, Inductors, Voltage Sources, Diodes and Transistors, Operational Amplifiers (OP), OP basic Circuits.
Recommended reading: See Ilias
Comments: