

Control Systems (ELB)

1	Module Number	Study Programme ELB	Semester 4	Offered in ☒WS ☒SS	Duration 1 Semester	Module Type Compulsory	Workload 150 h	ECTS Points 5
2	Courses		Teaching and Learning Forms		Contact Time		Self-Study Time	Language
					(SWS)	(h)	(h)	
	a) Control Systems		Lecture / Exercise		4	60	75	English
	b) Laboratory Control Systems		Laboratory		1	15		
3	Learning Outcomes and Competences Once the module has been successfully completed, the students can design, simulate, and control model-based mechatronic systems. Knowledge and Understanding The students ... - understand the importance of simulation and control engineering in mechatronics. - know the different options and constraints for applying simulation methods in mechatronics. - know standard transfer elements (e.g., P, I, PT1, PT2), standard controllers (e.g., P, PI, PID), and the structure and operating principle of a standard closed-loop control system. - understand the mathematical methods used to describe, analyze, and synthesize control systems in the Laplace and z domains. Use, Application and Generation of Knowledge <i>Use and Transfer</i> - simulate and control mechatronic systems in the time domain and present the results. - analyze, design, and commission control systems in the Laplace and z domains. - apply this knowledge to selected mechatronic examples. Interdisciplinary Competences <i>Communication and Cooperation</i> The students ... - present and discuss questions and solutions in simulation and control engineering with specialists. - develop solution concepts as a team using practical exercises. - analyze and solve control-engineering tasks. Scientific Self-Conception / Professionalism - derive recommendations for decisions from their analyses and evaluations, including from societal and ethical perspectives. - justify the developed solution theoretically and methodologically. - reflect on and assess their own abilities in comparison with those of the group.							
4	Contents a) Control Systems: - Introduction: block diagrams, open-loop and closed-loop control, application examples. - Description and behavior of control systems: transfer elements, differential equations, Laplace transform, frequency response, Bode plot, Nyquist plot, transfer function, system responses, and block diagrams. - Modeling of controlled plants; identification in the time and frequency domains - Simulation of dynamic systems, numerical integration methods, and step-size control - Analysis of closed-loop control systems: stability criteria, steady-state accuracy, reference tracking, and disturbance response - Controller synthesis: requirements and performance characteristics, practical tuning rules, compensation methods, controller design using Bode plots, and standard analog controllers (PID controllers) b) Laboratory Control Systems: - Experiment 1: Identification of a controlled plant in the time domain - Experiment 2: Identification of a controlled plant in the frequency domain							

	- I Experiment 3: Tracking control - I Experiment 4: Airflow control
5	Participation Requirements Compulsory: Admission to the second stage of the degree program Recommended: none
6	Examination Forms and Prerequisites for Awarding ECTS Points a) Written examination (90 minutes) b) Successful completion of the laboratory work with a report (ungraded)
7	Further Use of Module 6127 Model-Based Controller Design
8	Module Manager and Full-Time Lecturer Prof. Fischer
9	Literature - I Lecture notes - I Lutz, H.; Wendt, W.: Handbook of Control Engineering, Harri Deutsch - I O. Föllinger: Control Engineering – Introduction to Its Methods and Applications
10	Last Updated 13.07.2026