

Syllabus

Kursbeschreibung

Titel der Lehrveranstaltung	Moderne Regelungstechnik
Code der Lehrveranstaltung	42412
Zusätzlicher Titel der Lehrveranstaltung	
Wissenschaftlich-disziplinärer Bereich	IINF-04/A
Sprache	Englisch
Studiengang	Bachelor in Elektrotechnik und Cyber-Physische Systeme
Andere Studiengänge (gem. Lehrveranstaltung)	
Dozenten/Dozentinnen	Prof. Karl Dietrich von Ellenrieder, Karl.vonEllenrieder@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/37038
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Erstes Semester
Studienjahr/e	3
KP	9
Vorlesungsstunden	36
Laboratoriumsstunden	54
Stunden für individuelles Studium	135
Vorgesehene Sprechzeiten	27
Inhaltsangabe	<ol style="list-style-type: none"> 1. Modelling and systems analysis in state space (dynamic system modelling in time domain and state-space representation). 2. Dynamic system response derived from state-space representation and steady-state error. 3. Stability in state space. 4. Control design in state space (Pole placement design techniques; controllability, observability, full-state observers).

	<p>5. Optimal control of dynamic systems (Problems with fixed and variable end-points as well as with equality and inequality constraints; maximum principle and Hamilton-Jacobi-Bellmann equation; linear quadratic regulator).</p> <p>6. Understanding of observers in control systems.</p> <p>7. Understanding of optimal state observers and Kalman filters.</p> <p>8. Computer-aided analysis and design using Matlab/Simulink.</p> <p>9. Implementation of controllers and experimental evaluation on real-hardware setups.</p>
Themen der Lehrveranstaltung	<p>1. Modelling and systems analysis in state space (dynamic system modelling in time domain and state-space representation).</p> <p>2. Dynamic system response derived from state-space representation and steady-state error.</p> <p>3. Stability in state space.</p> <p>4. Control design in state space (Pole placement design techniques; controllability, observability, full-state observers).</p> <p>5. Optimal control of dynamic systems (Problems with fixed and variable end-points as well as with equality and inequality constraints; maximum principle and Hamilton-Jacobi-Bellmann equation; linear quadratic regulator).</p> <p>6. Understanding of observers in control systems.</p> <p>7. Understanding of optimal state observers and Kalman filters.</p> <p>8. Computer-aided analysis and design using Matlab/Simulink.</p> <p>9. Implementation of controllers and experimental evaluation on real-hardware setups.</p>
Stichwörter	automatic control, state space, control design, linear observers, linear quadratic regulators
Empfohlene Voraussetzungen	Lectures and exercises of Mathematical Analysis I and II; Linear Algebra; Physics I; Physics II; and Fundamentals of Systems and Control
Propädeutische Lehrveranstaltungen	
Unterrichtsform	Lessons are divided into i) theoretical classroom lessons, ii) classroom exercises, and iii) lab exercises.
Anwesenheitspflicht	Attendance at lectures, exercises, and labs is strongly recommended
Spezifische Bildungsziele und erwartete	<p>Knowledge and understanding</p> <p>Knowledge and understanding in the field of:</p>

Lernergebnisse	<ol style="list-style-type: none"> 1. State-space modelling and control 2. Optimal control 3. Observers <p>Applying knowledge and understanding</p> <ol style="list-style-type: none"> 4. Ability to apply knowledge for solving given problems, including solving them with numerical data using software packages like Matlab/Simulink and their implementation and evaluation on real hardware setups. <p>Making judgements</p> <ol style="list-style-type: none"> 5. Ability to judge plausibility of results. <p>Communication skills</p> <ol style="list-style-type: none"> 6. In-class exercises will require you justify your solutions/conclusions concisely (in clear and simple language). <p>Ability to learn</p> <ol style="list-style-type: none"> 7. Learning skills to independently study and apply methods of modern control for specific applications beyond topics covered in this lecture.
Spezifisches Bildungsziel und erwartete Lernergebnisse (zusätzliche Informationen)	The student should understand the basic principles of methods of modern control with focus on state-space control and optimal control and be able to apply them in exercises, including in Matlab and Simulink, as well as in laboratory experiments on real hardware.
Art der Prüfung	<p>Written Final Exam (Theory) 60% Length /duration: 3 hours</p> <p>Laboratory Final Exam (Measurements + report) 40% Length /duration: 1 hour</p> <p>ILOs assessed: 1-7</p>
Bewertungskriterien	<p>Written Final Exam: Completeness and correctness of answers; level of understanding.</p> <p>Laboratory Final Exam: Completeness and correctness of report; level of observation of physical processes.</p> <p>Students must receive an overall grade of greater than 60/100 points to pass the course.</p>
Pflichtliteratur	Lecture notes provided

Weiterführende Literatur	Additional books and articles may be recommended by the instructor during the course.
Weitere Informationen	
Ziele für nachhaltige Entwicklung (SDGs)	Hochwertige Bildung