

Syllabus

Descrizione corso

Titolo insegnamento	Controllo Moderno
Codice insegnamento	42412
Titolo aggiuntivo	
Settore Scientifico-Disciplinare	IINF-04/A
Lingua	Inglese
Corso di Studio	Corso di laurea in Ingegneria Elettronica e dei Sistemi ciberfisici
Altri Corsi di Studio (mutuati)	
Docenti	prof. Karl Dietrich von Ellenrieder, Karl.vonEllenrieder@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/37038
Assistente	
Semestre	Primo semestre
Anno/i di corso	3
CFU	9
Ore didattica frontale	36
Ore di laboratorio	54
Ore di studio individuale	135
Ore di ricevimento previste	27
Sintesi contenuti	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). 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

	<p>equation; linear quadratic regulator).</p> <ol style="list-style-type: none"> Understanding of observers in control systems. Understanding of optimal state observers and Kalman filters. Computer-aided analysis and design using Matlab/Simulink. Implementation of controllers and experimental evaluation on real-hardware setups.
Argomenti dell'insegnamento	<ol style="list-style-type: none"> Modelling and systems analysis in state space (dynamic system modelling in time domain and state-space representation). Dynamic system response derived from state-space representation and steady-state error. Stability in state space. Control design in state space (Pole placement design techniques; controllability, observability, full-state observers). 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). Understanding of observers in control systems. Understanding of optimal state observers and Kalman filters. Computer-aided analysis and design using Matlab/Simulink. Implementation of controllers and experimental evaluation on real-hardware setups.
Parole chiave	automatic control, state space, control design, linear observers, linear quadratic regulators
Prerequisiti	Lectures and exercises of Mathematical Analysis I and II; Linear Algebra; Physics I; Physics II; and Fundamentals of Systems and Control
Insegnamenti propedeutici	
Modalità di insegnamento	Lessons are divided into i) theoretical classroom lessons, ii) classroom exercises, and iii) lab exercises.
Obbligo di frequenza	Attendance at lectures, exercises, and labs is strongly recommended
Obiettivi formativi specifici e risultati di apprendimento attesi	<p>Knowledge and understanding</p> <p>Knowledge and understanding in the field of:</p> <ol style="list-style-type: none"> State-space modelling and control Optimal control Observers

	<p>Applying knowledge and understanding</p> <p>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> <p>Making judgements</p> <p>5. Ability to judge plausibility of results.</p> <p>Communication skills</p> <p>6. In-class exercises will require you justify your solutions/conclusions concisely (in clear and simple language).</p> <p>Ability to learn</p> <p>7. Learning skills to independently study and apply methods of modern control for specific applications beyond topics covered in this lecture.</p>
Obiettivi formativi specifici e risultati di apprendimento attesi (ulteriori info.)	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.
Modalità di esame	<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>
Criteri di valutazione	<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>
Bibliografia obbligatoria	Lecture notes provided
Bibliografia facoltativa	Additional books and articles may be recommended by the instructor during the course.
Altre informazioni	

Obiettivi di Sviluppo Sostenibile (SDGs)	Istruzione di qualità
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