UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH

Course guide
300107 - CONTROL - Control Systems Theory and Control Engineering

Last modified: 22/01/2026

Unit in charge:	Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit:	**Degree:** MASTER'S DEGREE IN ARTIFICIAL INTELLIGENCE FOR CONNECTED INDUSTRIES (AI4CI) (Syllabus 2025). (Optional subject).

Academic year: 2025   **ECTS Credits:** 4.0   **Languages:** English

LECTURER

Coordinating lecturer:	Soenke Rhein (Univ. Ulm)
	Mylene Pischella (CNAM Paris)
	Steffen Moser (Univ. Ulm)
	Juan Carlos Aguado (UPC)

Others:

PRIOR SKILLS

- Fundamentals of higher mathematics, especially linear algebra
- Fundamentals of signals and systems
- Basic design methods for LTI systems in frequency domain
- Description of linear, time-invariant systems in time and frequency domain,
- Laplace transform, analysis of LTI systems (Bode and Nyquist plots)

TEACHING METHODOLOGY

Online lectures and activities

LEARNING OBJECTIVES OF THE SUBJECT

Students are able to discuss control theory in time domain. They are capable of applying the methods of model-based control theory of linear and non-linear systems. To an increasing degree, requirements on safety, sustainability and economic feasibility of technical products and production plants call for modern approaches of control-theory-based methods. Especially in the environment of control theory, simple and heuristically designed controllers have been reaching their limits. Systematic design of model-based controllers in the time domain allows considering of non-linearities and has the potential to achieve significantly improved controller results. Students are able to describe the necessary mathematics and system-theory basics. They are able to analyze time-continuous systems in the time domain. They are able to categorize systems according to system-theoretic properties. Further, they have the ability to apply formal methods in order to design controllers in time domain. They are also able to apply methods for designing controllers for non-linear systems and are capable of managing its operation.

STUDY LOAD

Type	Hours	Percentage
Self study	64,0	64.00
Hours large group	36,0	36.00

Total learning time: 100 h

CONTENTS

Control System Theory and Control Engineering

Description:
- Linear and non-linear time-continuous systems in state space
- Linearization and general solution of linear differential equations of states
- Structural properties of LTI systems in state space (stability, controllability, observability
- Design of state controllers and state observers for linear systems
- Analysis of non-linear systems (Lyapunov-stability)
- Control and feedback control of non-linear systems

Full-or-part-time: 100h
Theory classes: 36h
Self study : 64h

GRADING SYSTEM

Exams