

Syllabus

Course description

Course title	Advanced control and feedback sensing
Course code	46057
Scientific sector	ING-INF/04
Degree	PhD in Advanced Systems Engineering (free choice)
Semester	2
Year	1, 2, 3
Academic Year	2022/23
Credits	3
Modular	//

Total lecturing hours	30
Attendance	Recommended
Prerequisites	Knowledge on systems and control of linear systems
Course page	

Specific educational objectives	The course aims to introduce the basic principles of advanced control techniques based on the acquisition and utilization of sensor signals.
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Lecturers	Seyed Mohsen Hosseini Niko Münzenrieder
Scientific sector of the lecturer	ING-INF/04 FIS/03
Teaching language	English
Office hours	After consultation and agreement with lecturer (Please register via email)
List of topics covered	<ol style="list-style-type: none"> 1. Fundamental properties of differential equations: existence/uniqueness, phase plane analysis. 2. Basic stability theory, Lyapunov functions, input-to-state stability. 3. Input-output stability, passivity, absolute stability. 4. Use of sensors for feedback control: sensor fusion and state estimation. 5. Overview of different sensor types and sensing modalities. 6. Analog front-end sensor conditioning and noise.
Teaching format	Lectures (blackboard / slides).

Learning outcomes (ILOs)	<p><u>Knowledge and understanding</u> Knowledge and basic understanding of physical and mathematical principles needed for advanced control systems and data collection.</p> <p><u>Applying knowledge and understanding</u> Ability to design functional systems considering real world limitations and imperfections.</p>
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	<p><u>Making judgements</u> Selection of appropriate controllers and stability analysis tools, sensing and conditioning technologies, as well as the critical evaluation of the signal quality.</p> <p><u>Communication skills</u> Ability to give a presentation supported by power-point, and oral communication skills using a technical language.</p> <p><u>Ability to learn</u> Ability to autonomously extend the knowledge acquired, as well as to identify and use relevant scientific papers / books.</p>
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Assessment	<p>Formative assessment Continuously as part of course-accompanying discussions</p> <p>Summative assessment Mandatory presentation given by each student</p>
Assessment language	English
Evaluation criteria and criteria for awarding marks	Quality of the final presentation.

Required readings	Lecture notes
Supplementary readings	<ul style="list-style-type: none"> • Applied Nonlinear Control J.J. E. Slotine, W. Li, 1991 • Nonlinear Systems H. K. Khalil, 2015 • Sensors and Transducers M.J. Usher, D.A. Keating, Macmillan, 1996 • Measurement & Instrumentation Principles A.S. Morris, Butterworth-Heinemann, 2001 • Principles of measurement systems J.P. Bentley, Longman, 1995