Control Systems

Code: 102737
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500895 Electronic Engineering for Telecommunication	OB	4

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

It is recommended to have studied and passed Fundamentals of Signals and Systems as well as knowledge of calculations and differential equations.

Objectives and Contextualisation

Understand the behavior of a linear system and get to design a regulator that allows good behavior both in terms of dynamics (stability) and tracking a slogan (accuracy).

• Knowledge: Analysis, through the methodology of Laplace, of the behavior of a continuous continuous system. In particular, stability and accuracy. Design of drivers, in series with the system, to achieve specific specifications.
• Skills: in this subject it is important to know how to use different graphic techniques that help both analysis and design, and they are: the Bode diagram, the place of roots, and the polar representation in order to be able to apply the criterion of stability MATLAB is also necessary to perform simulations of the behavior of the system.
• Skills: Oral and written communication, Capacity for analysis and synthesis; critical reasoning; ability to solve problems.

Competences

- Apply electronics as a support technology in other fields and activities, and not only in the field of Information and Communication Technologies
- Communication
- Conceive, design, implement and operate electronic instrumentation and control equipment and systems.
- Develop personal attitude.
- Develop personal work habits.
- Develop thinking habits.
- Learn new methods and technologies, building on basic technological knowledge, to be able to adapt to new situations.
- Perform measurements, calculations, estimations, valuations, analyses, studies, reports, task-scheduling and other similar work in the field of telecommunication systems
- Resolve problems with initiative and creativity. Make decisions. Communicate and transmit knowledge, skills and abilities, in awareness of the ethical and professional responsibilities involved in a telecommunications engineer's work.
- Work in a multidisciplinary group and in a multilingual environment, and communicate, both in writing and orally, knowledge, procedures, results and ideas related with telecommunications and electronics
- Work in a team.

Learning Outcomes

1. Apply electronic energy transformation control systems, especially to the field of renewable energy.
2. Apply electronics as a support technology in other fields and activities, and not only in the field of Information and Communication Technologies.
3. Assume and respect the role of the different members of a team, as well as the different levels of dependency in the team.
4. Communicate efficiently, orally and in writing, knowledge, results and skills, both professionally and to non-expert audiences.
5. Design analogue and digital, analogue-digital conversion and digital analogue electronic circuits for telecommunication applications and computing.
6. Develop critical thinking and reasoning.
7. Develop independent learning strategies.
8. Develop the capacity for analysis and synthesis.
9. Document the specifications, design, implementation and testing of instrumentation and control systems.
10. Identify problems with electromagnetic interference and compatibility.
11. Maintain a proactive and dynamic attitude with regard to one's own professional career, personal growth and continuing education. Have the will to overcome difficulties.
12. Perform the specification, implementation, documentation and fine-tuning of electronic instrumentation and control equipment and systems , considering technical aspects and the relevant regulatory requirements.
13. Specify and use electronic instrumentation and measurement systems.
14. Translate the concept of noise to electronic systems and analyse its effects on instrumentation circuits.
15. Use IT tools for the development of instrumentation and control systems.
16. Use communication and computer applications to support the development and operation of electronic applications.
17. Use feedback theory and electronic control systems.
18. Work autonomously.
19. Work cooperatively.

Content

The course is structured in the following topics:

Control Engineering: In this first topic we will present Control Engineering as a discipline. The general control framework will be presented based on several examples and its historical interpretation.

Models: The different ways of representing dynamic linear systems and the approaches of classic and modern control will be presented. From the Laplace Transform, the systems will be represented by a block diagram whose algebra will be studied.

Controlled Control Systems: Principles of analysis and operation of control systems based on feedback. Signals involved and analysis relationships.

Linearity: generation of linear models based on non-linear descriptions of the system to be controlled. Concept of point of operation and of incremental and absolute variables.

Permanent Regime: Analysis of the behavior of the system in stationary regime. Characterization of the error constants that allow us to evaluate the performance of the system with respect to the ability to follow reference entries with zero error.

Stability and Robustness: Methods to evaluate the stability of the closed loop system from the models of the open loop system and the controller to be used. It presents the idea of robustness as tolerance to errors in the model as a representation of the real system to be controlled.

PID controllers: The most used driver at the industrial level, the PID controller, will be presented. The different existing formulations, meaning of their parameters, methods of design and tuning, etc.

IMC control: Analytical design method I usually get the PID but can also be used to design PID controllers. The control methodology is presented by internal model (IMC), which allows you to achieve specifications on slogan tracking and on dynamics (rapidity, swings, ...).

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Supervised			
Classes de Problemes	15	0.6	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19
Classes de Pràctiques	15	0.6	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19
Classes de Teoria	30	1.2	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18
Type: Autonomous			
Estudi i Ressolcuió de problemes	60	2.4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19

This subject has a marked engineering character.

Theory: It is more of a methodology, so it is considered from a fairly applied point of view.

Practices: Problems related to the direct application of the concepts seen in class are studied with simulation. The completion of the internship is mandatory and the student is evaluated throughout the sessions according to their performance in the sessions. Prior preparation work will also be taken into account.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Proves escrites	40%	3	0.12	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 17, 18, 19
Pràctiques	30%	7	0.28	1, 2, 3, 4, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 18, 19
Treball	30%	20	0.8	1, 2, 3, 4, 6, 7, 8, 9, 11, 13, 15, 17, 18, 19

This subject is evaluated based on three grades

Exam: Written exam to carry out during the subject
Practices: Laboratory practices
Work: a control project in which you will have to face a control problem based on the elements seen during the course. You will have to submit a report and make a presentation.

The final grade of the subject is calculated based on

FINAL_GRADE=0.4*Exam+0.3*Practices+0.3*Work

A mínimum of 4 in each one of the three parts is needed

Those students who do not pass the subject based on the continuous evaluation, have the option of a second call in which:

Exam: written exam to carry out the day the exam of the subject is scheduled at the end of the semester
Practices: If they have not been passed during the course, an exam may be made

Bibliography

Modern Control Systems. R.C. Dorf.
Sistemas de Control en Ingenieria. Paul H. Lewis, Chang Yang

Ingeniería de Control Moderna. K. Ogata

Software

MATLAB/Simulink

Language list

Name	Group	Language	Semester	Turn

(PAUL) Classroom practices	321	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	321	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	322	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	323	Catalan	first semester	morning-mixed
(TE) Theory	320	Catalan	first semester	morning-mixed