Universitat Autònoma de Barcelona

2019/2020

Control Systems

Code: 102737
ECTS Credits: 6

Degree	Type	Year	Semester
2500895 Electronic Engineering for Telecommunication	OB	4	1

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: Yes

Teachers

Ramón Vilanova Arbós

Prerequisites

• Prerequisites: there are none

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 engineers 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 ones 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, ...).

Methodology

This subject has a marked engineer status. Theory: it is rather a methodology, therefore it is not very different from the Problems. Practices: with simulation we study the problems with calculation, which helps to understand them better. That is why the student must do the exercises that are proposed. Since the group is not large, theoretical class hours will be devoted to seminars in which "students" are forced to participate in the discussions on the topics already explained in theory. The realization of the
Practices are mandatory and the student is evaluated throughout the sessions according to their performance in the sessions. The previous preparation work will also be taken into account.

Activities

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

Assessment

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

NOTA_FINAL = 0.45 * NoteExamen + 0.3 * NotaPrécticas + 0.25 * NotaTreball

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

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Proves escrites	45%	3	0.12	1, 2, 3, 4, 7, 8, 6, 5, 9, 13, 10, 11, 14, 19, 18, 15, 17
Pràctiques	30%	7	0.28	1, 2, 3, 4, 7, 8, 6, 9, 13, 11, 12, 19, 18, 16, 15, 17
Treball	25%	20	0.8	1, 2, 3, 4, 7, 8, 6, 9, 13, 11, 19, 18, 15, 17

Bibliography

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

Ingeniería de Control Moderna. K. Ogata