



Course guides

230657 - CTA - Control Theory and Applications

Last modified: 29/04/2020

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Optional subject).
MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Optional subject).
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).

Academic year: 2020 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: DOMINGO BIEL, FRANCESC GUINJOAN

Others: ALBERTO POVEDA, EDUARD ALARCÓN

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Transversal:

1. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.
2. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

- Lectures
- Laboratory classes
- Exercises
- Other activities
- Extended answer test (Final Exam)

LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives of the subject:

The aim of this course is to introduce the students in time-domain and frequency-domain methods used to analyse and design linear control systems in both continuous and discrete-time fields.

Learning results of the subject:

- Ability to understand the basic concepts related to feedback system in both continuous-time and discrete-time fields.
- Ability to apply the root locus technique and the Routh stability criteria for the analysis of control systems.
- Ability to design the proper controllers to verify some control specifications in both time-domain and frequency domain.



STUDY LOAD

Type	Hours	Percentage
Self study	86,0	68.80
Hours large group	39,0	31.20

Total learning time: 125 h

CONTENTS

1. Introduction to linear control systems

Description:

- Basic components of a control system, reference, control, output and disturbance signals.
- Control system goals.
- Continuous-time control and discrete-time control.
- Dynamic systems classification: linear and nonlinear systems, time-varying and time-invariant systems.
- Transfer function of linear systems.

Full-or-part-time: 10h

Theory classes: 2h

Self study : 8h

2. Continuous-time control systems analysis

Description:

- Transient and steady-state time-response of linear systems.
- First and second-order systems.
- Transient response characterization: settling time, maximum overshoot, etc.
- Higher order systems: transient response approximation through dominant poles and zero-pole cancellation.
- Routh-Hurwitz stability criteria.
- Root locus analysis.
- Steady-state error.

Full-or-part-time: 24h

Theory classes: 6h

Self study : 18h

3. Continuous-time control systems design

Description:

- Control design through root locus.
- First and second-order controllers.
- PID controllers.
- Implementation issues of PID controllers.

Full-or-part-time: 28h

Theory classes: 6h

Laboratory classes: 6h

Self study : 16h



4. Analysis of control systems in frequency domain

Description:

- Frequency response of linear systems.
- Nyquist diagram and Bode diagram.
- Relative stability: gain margin and phase margin.

Full-or-part-time: 9h

Theory classes: 3h

Self study : 6h

5. Frequency-domain control design

Description:

- Frequency-domain specifications: relative stability margins and bandwidth of a control system.
- Lead-lag and phase-lag compensations.

Full-or-part-time: 24h

Theory classes: 5h

Laboratory classes: 2h

Self study : 17h

6. Discrete-time control systems

Description:

- Introduction to discrete-time control systems.
- The Z transform.
- Z Plane analysis of discrete-time systems.
- Design of discrete-time control systems by conventional methods.

Full-or-part-time: 30h

Theory classes: 4h

Laboratory classes: 5h

Self study : 21h

ACTIVITIES

LECTURES

EXERCISES

Description:

Exercises to strengthen the theoretical knowledge.

OTHER ACTIVITIES

Description:

Numerical simulation homework



EXTENDED ANSWER TEST (FINAL EXAM)

Description:

Final examination.

GRADING SYSTEM

Mid course exam (50%)

Final exam (50%)

BIBLIOGRAPHY

Basic:

- Golnaraghi, F.; Kuo, B.C. Automatic control systems. 9th ed. New York: John Wiley & Sons, 2010. ISBN 9780470048962.
- Ogata, K. Modern control engineering. 5th ed. Boston: Pearson, 2010. ISBN 9780137133376.

Complementary:

- Gomáriz, S.; Biel, D.; Matas, J.; Reyes, M. Teoría de control: diseño electrónico [on line]. 2a ed. Barcelona: Edicions UPC, 2000 [Consultation: 04/03/2015]. Available on: <http://hdl.handle.net/2099.3/36214>. ISBN 8483012669.