Last update: 06-05-2019

230657 - CTA - Control Theory and Applications

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 710 - EEL - Department of Electronic Engineering

Academic year: 2019

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

ECTS credits: 5 Teaching languages: English

Teaching staff

Coordinator: 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.

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Study load

Total learning time: 125h	Hours large group:	39h	31.20%
	Hours medium group:	0h	0.00%
	Hours small group:	0h	0.00%
	Guided activities:	0h	0.00%
	Self study:	86h	68.80%

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Content

1. Introduction to linear control systems

Learning time: 10h

Theory classes: 2h
Self study : 8h

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.

2. Continuous-time control systems analysis

Learning time: 24h

Theory classes: 6h
Self study : 18h

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-Hurtwitz stability criteria.
- Root locus analysis.
- Steady-state error.

3. Continuous-time control systems design

Learning time: 28h

Theory classes: 6h
Laboratory classes: 6h
Self study : 16h

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

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4. Analysis of control systems in frequency domain	Learning time: 9h Theory classes: 3h Self study : 6h

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

5. Frequency-domain control design	Learning time: 24h Theory classes: 5h Laboratory classes: 2h Self study : 17h

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

6. Discrete-time control systems	Learning time: 30h Theory classes: 4h Laboratory classes: 5h Self study : 21h

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.

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Planning of activities

LECTURES

EXERCISES

Description:
Exercises to strengthen the theoretical knowledge.

OTHER ACTIVITIES

Description:
Numerical simulation homework

EXTENDED ANSWER TEST (FINAL EXAM)

Description:
Final examination.

Qualification 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.