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340129 - REAU-K5O07 - Automatic Regulation

Coordinating unit: 340 - EPSEVG - Vilanova i la Geltrú School of Engineering

Teaching unit: 707 - ESAII - Department of Automatic Control

Academic year: 2018

Degree: BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)

ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: RAMON GUZMAN SOLA

Others: FRANCISCO JAVIER RUIZ VEGAS
RUBEN LUMBIARRES LÓPEZ
RAMON GUZMAN SOLA

Prior skills

It is very convenient to have taken and passed the Fundamentals of Automatic course.

Degree competences to which the subject contributes

Specific:

1. CE25. Knowledge and ability of systems modeling and simulation.
2. CE26. Knowledge of automatic regulation and control techniques and its application into industrial automatization.
3. CE29. Ability to design automotion control systems.

Teaching methodology

Classroom training activities
· Participatory Lectures
· Conducting individual and team exercises
· Perform computer labs in
· Project Implementation Team
· Report writing and oral defense of problems, practices and projects
Educational activities outside the class:
· Perform exercises and theoretical or practical projects outside the classroom, individual and / or group.
· Review of theoretical concepts, study, work and individual and group analysis
· Tutoring and formative evaluation of the learning process

Learning objectives of the subject

The aim of this course is to provide basic knowledge of linear control systems description in discrete time in order to be able to design some discrete controllers.

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Study load

Total learning time: 150h	Hours large group:	30h	20.00%
	Hours medium group:	0h	0.00%
	Hours small group:	30h	20.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

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Content

Module 1: Introduction to control systems in discrete ti

Learning time: 18h
Theory classes: 6h
Self study : 12h

Description:
Objective
The aim of this first module is to introduce the basic architecture of digital control systems, applicability and benefits of their use.

Subsections:
* Types of signals
* Digital control systems
* DAC and ADC converters
* Supervisor control vs direct digital control
* Advantages of digital control vs analogic control

Module 2: Mathematical models in discrete time

Learning time: 18h
Theory classes: 6h
Self study : 12h

Description:
Objective
The aim of this second module is to present the mathematical tools that are used to analyze control systems in discrete time. Will relate these techniques with the techniques used to analyze continuous systems.
Content

* Z transform definition and properties
* Methods of calculating the Z transform and its inverse

Module 3: Signal sampling and reconstruction

Learning time: 18h
Theory classes: 6h
Self study : 12h

Description:
Content:
* Ideal sampling or impulse sampling
* Sampled signal spectrum. Shannon Theorem. Ideal filter
* 0 and 1 order holder
* Star transform
* Empiric rule

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Module 4: Discrete transform function	Learning time: 24h Theory classes: 8h Self study : 16h

Description:
Content:
* Equivalent discrete transform function
* Blocs diagrams. Simplification

Module 5: Time response and stability	Learning time: 18h Theory classes: 6h Self study : 12h

Description:
Content:
* Relation betwenn s and z plains
* Routh stability criterion (bilinear transform)
* Jury stability criterion
* steady state error in discrete systems

Module 6: Discrete controllers design	Learning time: 42h Laboratory classes: 14h Self study : 28h

Description:
Content:
* Design of conventional controllers in s plane
* Discretization of continuous controllers
* Design of discrete controllers in z plane

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Qualification system

There will be a first test (P) in the middle of the semester and a second test (F) at the end of the semester. The theory grade of the subject is calculated by the formula T=max(0.5·(P+F),F).

In the laboratory part, two exams are proposed: a mid term exam (LP) and a final exam (LF). The lab grade will be: L=0.5·LP+0.5·LF

The final grade is calculated as follows: 0.65·T+0.35·L

Re-assessment can be done by students with grades from 3 to 4.9. Re-assessment R sustitute grade F and final grade is calculated as

min(5, 0.65·TR+0.35·L) , where:
TR=max(R, (P+R)/2)

Bibliography

Basic:

Ogata, Katsuhiko. Sistemas de control en tiempo discreto. 2a ed. México [etc.]: Prentice Hall Hispanoamericana, 1996. ISBN 9688805394.

Phillips, Charles L.; Nagle, H. Troy. Digital control system analysis and design. 3rd ed. Englewood Cliffs, N.J: Prentice-Hall International, 1995. ISBN 013309832X.