Course guide
340104 - REAU-E5O07 - Automatic Regulation

Last modified: 17/05/2023

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control.

Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: FRANCISCO JAVIER RUIZ VEGAS

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. CE26. Knowledge of automatic regulation principals and its application in industrial automation.

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.

STUDY LOAD

Type	Hours	Percentage
Hours small group	30,0	20.00
Hours large group	30,0	20.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

Module 1: Introduction to control systems in discrete time

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

Full-or-part-time: 18h
Theory classes: 6h
Self study : 12h

Module 2: Mathematical models in discrete time

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

Full-or-part-time: 18h
Theory classes: 6h
Self study : 12h

Module 3: Signal sampling and reconstruction

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

Full-or-part-time: 18h
Theory classes: 6h
Self study : 12h

Module 4: Discrete transform function

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

Full-or-part-time: 24h
Theory classes: 8h
Self study : 16h

Module 5: Time response and stability

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

Full-or-part-time: 18h
Theory classes: 6h
Self study : 12h

Module 6: Discrete controllers design

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

Full-or-part-time: 42h
Laboratory classes: 14h
Self study : 28h

GRADING 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 and 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:
- Phillips, Charles L.; Nagle, H. Troy; Chakrabortty, Aranya. Digital control system analysis and design [on line]. 5th ed. Boston: Pearson Prentice Hall, 2015 [Consultation: 13/02/2024]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5174338. ISBN 9781292061887.
- Ogata, Katsuhiko. Sistemas de control en tiempo discreto. 2a ed. México [etc.]: Prentice Hall Hispanoamericana, 1996. ISBN 9688805394.