30025 - Control Engineering

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	436 - Bachelor's Degree in Industrial Engineering Technology
ECTS	6.0
Course	3
Period	Second semester
Subject Type	Compulsory
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

This course is divided in three main parts: (1) digital control of continuous systems; (2) state space representation and (3) modeling, analysis and design of discrete event systems. The teaching process will involve three main activities: lectures, problems resolution and laboratory classes.

- During the lectures, theoretical and methodological concepts will be presented by using practical examples.
- During the problem resolution classes, different problems will be developed with the participation of students.
- Laboratory sessions will be developed individually or in groups of two students, where students will put into practice the concepts of interest, implement control systems on real systems and simulate using the computers the evolution of systems.

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5.2.Learning activities

The activities for the student include the following.
1) Lecture classes (type T1) (30 hours).
Lecture sessions of theoretical and practical content. The concepts of digital control of continuous systems and modeling, analysis and control of discrete event systems are introduced by using real examples. Student participation through questions and brief discussions is encouraged.
2) Classes of problems and resolution of use cases (type T2) (15 hours).
Problems and case studies with student participation, coordinated at all times with the theoretical contents are developed. Students are encouraged to work the problems previously.
3) Laboratory sessions (type T3) (15 hours).
The student performs simulation, design and implement control systems on real systems. The sessions consist in a preliminary study and a practical realization in the laboratory. The preliminary study should be done prior to practice.
4) Study (type T7) (86 hours).
Student personal study of theoretical concepts and implementation problems. The ongoing work of the student is encouraged by the homogeneous distribution throughout the semester of the various learning activities. This includes tutorials, as a direct student care, identification of learning problems, guidance on the subject, attention to exercise and doubts.
5) Evaluation exams (T8) (4 hours).
In addition to the qualifying function, evaluation is also a learning tool with which the student checks the degree of understanding and assimilation reached.

5.3.Program

The course contents are:

- Topic 1: Introduction
- Topic 2: Digital control of continuous systems
  - Discrete-time signals
  - Z transform: definition, properties, tables
  - Description of sampled systems
  - Discretization of continuous systems
  - Sampled Systems Analysis
  - Design of digital controllers
  - Topic 1: Introduction
- Topic 3 : Internal description systems.
  - I nternal description of continuous systems
  - I nternal description of sampled systems
  - Basic operations in the state space
  - System poles
  - Stationary response
  - Controllability and observability
- Topic 4: Discrete (event) systems
  - Preliminary considerations and definition
  - Formalisms to represent the DES and interest in engineering
  - Deterministic Finite Automaton (DFA)
    - Mealy and Moore models. Transformations and minimization
    - Limitations of DFA
  - Petri nets
    - Concept, typical structures and modeling methodology
    - Some properties, analysis and implementation techniques

Laboratory sessions to be performed:

- Digital control of a servomechanism (discretization of continuous controllers).
- D igital control of a servomechanism (direct design).

- Control of a discrete event system (DFA implementation).
- Control of a flexible manufacturing cell (Petri net implementation).
- Analysis of discrete systems in MATLAB.

5.4.Planning and scheduling

All classes are scheduled by EINA and are available on its website (https://eina.unizar.es/).
Each teacher publish its schedule of office hours .
The other activities are planned depending on the number of students and are a vailable at http://add.unizar.es

5.5.Bibliography and recomended resources

The following books can be used by the students, all of them can be found using library resources as the site http://biblioteca.unizar.es/como-encontrar/bibliografia-recomendada .

- Smith, Carlos A.. Principles and practice of automatic process control / Carlos A. Smith, Armando B. Corripio . - 3rd ed. Hoboken, NJ : John Wiley & Sons, cop. 2006
- Moreno, Luis. Ingeniería de control : Modelado, análisis y control de sistemas dinámicos / Luis Moreno, Santiago Garrido y Carlos Balaguer . 1a. ed. Madrid: Ariel, 2003 [Capítulo 6]
- Ogata, Katsuhiko. Ingeniería de control moderna / Katsuhiko Ogata ; traducción Sebastián Dormido Canto, Raquel Dormido Canto ; revisión técnica Sebastián Dormido Bencomo ; revisión técnica para Latinoamérica Amadeo Mariani ... [et al.] . - 5ª ed. Madrid : Pearson Educación, D.L. 2010
- Cassandras, Christos. Introduction to Discrete Event Systems / Cassandras, C.G. & S. Lafortune. Springer, 2008.
- Silva Suárez, Manuel. Las redes de Petri : en la automática y la informática / Manuel Silva . - 1a ed. 1985, 1a reimp. 2002 Madrid : Editorial AC, 2002