60821 - Evaluation and control of production systems

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	532 - Master's in Industrial Engineering
ECTS	6.0
Course	2
Period	Second semester
Subject Type	Optional
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

The main objective of this course is to provide students with knowledge of modeling , analysis and control of concurrent discrete systems , whether distributed or not , with main application to production systems . Production systems will be understood in a general purpose , studying applications in four areas of application: manufacturing systems , logistics systems, workflows and path planning of mobile robots.

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.

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 content of the course is the following :

- Introduction
- Deterministic finite automata
- Untimed Petri nets
- Elements of linear programming and convex geometry
- Production models in discrete time
- Analysis of untimed (autonomous) Petri nets
- Stochastic Petri nets and Markov chains
- Performance evaluation : bounds
- Performance evaluation : Approximations

Laboratory sessions to be performed are :

- Modeling and analysis with Place/ Transition Petri nets
- Modeling and analysis with Colored Petri nets
- Path planning for multi-robot systems
- Performance Evaluation of manufacturing systems

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

60821 - Evaluation and control of production systems

5.5.Bibliography and recomended resources

- 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
- T. Murata, "Petri nets: Properties, analysis and applications," in *Proceedings of the IEEE* , vol. 77, no. 4, pp. 541-580, Apr 1989.
- Girault, Claude, Valk, Rüdiger: "Petri Nets for Systems Engineering: A Guide to Modeling, Verification, and Applications", Springer-Verlag Berlin Heidelberg, 2003
- Kurt Jensen, Lars M. Kristensen: "Coloured Petri Nets Modelling and Validation of Concurrent Systems", Springer Berlin Heidelberg, 2009
- Manuel Silva, Enrique Teruel, José Manuel Colom: "Linear algebraic and linear programming techniques for the analysis of place/transition net systems", in Lectures on Petri Nets I: Basic Models, pp 309-373, 1998
- M. Ajmone Marsan, G. Balbo, G. Conte, S. Donatelli, G. Franceschinis: "Modelling with Generalized Stochastic Petri Nets," Wiley Series in Parallel Computing, John Wiley and Sons, 1995
- J. Campos, G. Chiola, J. Colom, M. Silva: "Properties and Performance Bounds for Timed Marked Graphs," IEEE Transactions on Circuits and Systems I: Fundamental Theory and Applications, vol. 39, no. 5, pp. 386-401, May 1992.