Process Control

Academic Year: (2023 / 2024) **Review date: 15-05-2023**

Department assigned to the subject: Systems Engineering and Automation Department

Coordinating teacher: GARRIDO BULLON, LUIS SANTIAGO

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Previous knowledge of Ordinary Differential Equations, Matrix Calculus and Automatic Control is assumed.

OBJECTIVES

Ability to design and project automated production systems and advanced process control

DESCRIPTION OF CONTENTS: PROGRAMME

1 Modeling and Analysis of Systems in State Space. 1.1 Introduction to the concept of state and state space. 1.2 Dynamic systems. 1.3 Linearity and invariance. 1.4 Linearization. 1.5 Representation of systems in state space. 1.6 Interconnection of systems. 1.7 Obtaining the state model. 1.8 Linear transformations. 1.9 Obtaining the transfer function from the state model.

2 Solution of the equations of state. 2.1 Transition matrix. 2.2 Calculation of the transition matrix. Properties. 2.3 Solution of the equations of state in discrete time systems.

3 Status feedback control. 3.1 Controllability and observability. 3.2 Complete controllability of the state of a system. 3.3 Complete controllability of a system's output. 3.4 Complete observability of the state of a system. 3.5 Invariance of controllability and observability before transformations. 3.6 Status feedback control: pole positioning method. 3.7 Adjusting the positions of the poles in a closed chain. 3.8 Gain adjustment. 3.9 Modification of the type of a system.

4 Design of state observers. 4.1 Concept of state observer. 4.2 Conditions for observing the state. 4.3 Complete order status observer. 4.4 Error dynamics in the complete order observer. 4.5 Design of the matrix of gains of the observer feedback. 4.6 Closed-loop dynamics of the system with state feedback and state observer.

LEARNING ACTIVITIES AND METHODOLOGY

The training activities include:
- Lectures, where knowledge that students should acquire will be presented. To facilitate their development students receive class notes and have basic reference texts that facilitates follow lessons and develop further work.
- Resolution of exercises by the student self-assessment and will serve to acquire the necessary skills.
- Classes of problems, which are developed and discuss the problems that are proposed to students.
- Lab, where students experimentally verify the theoretical concepts and results seen in class.
- Lab in computer room where computer are resolved proposed problems.

- Lectures, classes resolution of questions in small groups, student presentations, individual tutorials and personal work, including research, tests and exams aimed at the acquisition of theoretical knowledge will involve 1.5 ECTS credits.
- Laboratory practices and kinds of problems in small groups, individual tutorials and personal work, including research, tests and exams aimed at the acquisition of practical skills related to the program will involve subjects 1.5 ECTS credits.

ASSESSMENT SYSTEM

The evaluation of the course is based on continuous assessment model. Total student's grade will be derived from the evaluation of the different activities proposed in the course. It will consist of a theoretical part and a practical part.

Ongoing evaluation of the theoretical part is conducted through two sets, so that:
* If both are approved, do not take the final exam. If the student still wants to present at the end to up note, the note tells which will exclusively serve in the end.
* If a part is suspended, the student must go to the end with that part. With the note you get on the final exam (approved or suspended), is made with the approved partial average, and if the score is 5 or greater, have passed the theoretical part.
* If the partials are suspended, it goes all the final exam and the note will directly serve the final theory.

And with regard to the practice, as is required with the theoretical part, will have to obtain a minimum of 5 to approve the subject.

Weighting: Test of theory, 90%. Lab, 10%

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

BASIC BIBLIOGRAPHY

- Tripathi Modern Control Systems: An Introduction, Jones & Bartlett Learning, 2010

ADDITIONAL BIBLIOGRAPHY

- NISE Control System Engineering, Wiley, 2018