Control Engineering III

Academic Year: (2020 / 2021) **Review date: 17-11-2020**

Department assigned to the subject: Systems Engineering and Automation Department

Coordinating teacher: GARRIDO BULLON, LUIS SANTIAGO

Type: Electives ECTS Credits : 6.0

Year : 4 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Control Engineering I, Control Engineering II

OBJECTIVES

Upon successful completion of this subject, students will be able to:

1. Have a systematic understanding of the key concepts and aspects of system identification, nonlinearity analysis and controller design through the different control methods: Smith predictor, optimal control in both the continuous and discrete domain.

2. Have adequate knowledge of your engineering branch that includes some knowledge at the forefront of your field in control engineering.

3. Apply their knowledge and understanding of control engineering to identify, formulate and solve engineering problems using established methods for the identification of systems and their optimal control.

4. Apply their knowledge to develop and carry out optimal controller designs that meet specific requirements.

5. Have an understanding of the different driver design methods and the ability to use them.

6. Have technical and laboratory skills to implement discrete control systems on real platforms.

7. Select and use appropriate equipment, tools and methods for the design and implementation of discrete controllers.

8. Combine theory and practice to solve driver design and implementation problems.

9. Have an understanding of methods and techniques applicable in the field of control engineering and their limitations.

DESCRIPTION OF CONTENTS: PROGRAMME

Unit 1. Identification of systems.
- 1.1. Parametric and nonparametric models.
- 1.2. Identification methods: transfer function, state space, impulse response, frequency response.
- 1.3. Least squares method.

Unit 2. Modeling of non-linear systems.
- 2.1. Types and effects.
- 2.2. Describing Function analysis. Limit cycle.
- 2.3. Phase plane analysis.

Unit 3. Stability.
- 3.1. Lyapunov Criterion.

Unit 4. Non-linear Systems Control:

4.1. Systems with delay. Smith Predictor.
4.2. Linearization by state feedback.
4.3. Application of Lie Algebra.

Unit 5. Optimal Control. Hamiltonian Formulation.
5.1. General problem (discrete-time)
5.2. Linear Quadratic Regulator (LQR) in discrete-time.
5.3. General problem (continuous-time)
5.4. Linear Quadratic Regulator (LQR) in continuous-time.

LEARNING ACTIVITIES AND METHODOLOGY

- Lectures, classes to resolve doubts in small groups, tutorials and personal work, oriented to the acquisition of knowledge.

- Laboratory practices and kinds of problems in small groups, individual tutorials and personal work, oriented to the acquisition of practical skills related to the program of the course.

ASSESSMENT SYSTEM

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

There will be five partial exams. The average score of the partial exams will be the 90% of the final score. The student has to pass the partial exams in order to pass the subject. If the student fails a partial exam, the corresponding part can be repeated in a recovery exam.

There will be three mandatory lab sessions of two hours each one. The average score of the lab sessions will be the 10% of the final score.

If the student does not go through the continuous evaluation process, the mark of the final exam will be the 60% of the final score.

BASIC BIBLIOGRAPHY

- L. Ljung System Identification, Prentice-Hall.

- Slotine Applied NonLinear Control, Prentice-Hall.