Control theory and applications

Academic Year: (2020 / 2021) **Review date: 16/05/2015 00:29:04**

Department assigned to the subject:

Coordinating teacher: IBORT LATRE, LUIS ALBERTO

Type: Electives ECTS Credits : 6.0

Year : 2 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

* Linear algebra
* Ordinary differential equations
* Partial differential equations

OBJECTIVES

* Solve problems of affine-linear control in one and more variables.
* Describe and solve of problems in motion.
* Describe and solve of simple problems in control mechanical systems and robotics.
* Solve of problems in optimal control LQ.
* Apply specific software in the solution of linear control systems.
* Solve Riccati equations.
* Apply Pontryagin's maximum principle to solve optimal control problems in engineering and economics.
* Analyze and apply bang-bang solutions to mechanical problems.

DESCRIPTION OF CONTENTS: PROGRAMME

* Basics in ordinary differential equations and control theory.
* Control theory of linear affine systems.
* Design of trajectories.
* Control of systems in Lie groups
* Optimal control theory: linear systems with regular and singular quadratic gains.
* Riccati equation and quadratic systems.
* Pontryagi's maximum principle.

LEARNING ACTIVITIES AND METHODOLOGY

* The academic activieties (1.4 ECTS) will be devided into the following formative aspects:

Expository lectures: Its aim is to present to the students the main notions and tools of the corresponding subject. Notes will be distributed during the course to facilitate the students understanding. An extensive bibliography will be also given in order that the students can deepen their knowledge of particular topics of interst.

Exercise or practical lectures: in these lectures (some of them to be held in the computer room) the students will develop their specific skills related to the topic. The students will also do oral and written presentations of subjects related to the course.

* Moreover, 1.4 ECTS will be devoted to tutorials: this activity aims at an independent learning of the student with a periodic supervision by the lecturer. It includes, for example, the reading and understanding of research papers. Corrections of problems or suggestions for presentations.

* The remaining credits (3.2) correspond to independent work by the student (without supervision by the lecturer). In this time the student will solve problems related to the course, read recommended bibliography and search for references and related material.
During this time the students may have access to the lecture room.

ASSESSMENT SYSTEM

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

Work assignment and exercises (40%). Final exam (60%).

BASIC BIBLIOGRAPHY

- E. D. Sontag Mathematical control theory : deterministic finite dimensional systems , Springer Verlag, 1998

- F. Bullo and A. D. Lewis Geometric Control of Mechanical Systems, Springer Verlag, 2004

- K. Zhou (with J.C. Doyle and K. Glover) Robust and Optimal Control, Prentice Hall, 1996

ADDITIONAL BIBLIOGRAPHY

- A.W. Naylor and G.R. Sell Linear Operator Theory in Engineering and Science, Springer Verlag, 1982

- E.R. Pinch Optimal control and the calculus of variations , Oxford University Press, 1993

- H.O. Fattorini Infinite Dimensional Linear Control Systems, Elsevier, 2005

- R.F.Curtain and H.J.Zwart An Introduction to Infinite-Dimensional Linear System Theory, Springer Verlag, 1995