OPTIMAL AND ADAPTIVE CONTROL

Mestrado em Engenharia Eletrónica e de Computadores

Code: 26803

Main Scientific Area: Intelligent Systems and Control

Lecturer: José Gerardo Vieira da Rocha

Language of Instruction: Portuguese

Regime: S1

Contact Hours: 30h Total Workload: 130h

ECTS: 6,0

Objectives

This course includes the analysis and development of non-linear control systems where examples of applications and case studies are presented. An extensive study of non-linear control systems is carried out and the themes of linearization, feedback, adaptive control and optimal control are also addressed. The main objectives of the U.C. are to prepare students to develop control applications for non-linear systems, namely robotic, fluid, electronic/electrical, mechanical and biological systems.

Learning Outcomes

Students who successfully complete this course should be able to:

- Distinguish between linear and non-linear control systems.

- Understand the Lyapunov stability method

- Understand the input-output stability associated to the concepts of feedback and transfer function

- Linearize a feedback loop

- Understand the main methods of optimal and adaptive control.

Course Contents

1. Introduction to the control of non-linear systems

2 Second order non-linear systems

3 Fundamental Properties of non-linear systems

4 Lyapunov Stability

5 Input-Output Stability

6 Feedback Linearization

7 Adaptive Control

8 Optimal Control

Recommended Bibliography

H. K. Khalil, Nonlinear Systems, 3rd. ed., Prentice Hall;

K: J. Astrom, B. Wittenmark, Adaptive Control, 2nd ed, Dover Publications;

D. E. Kirk, Optimal Control Theory - an Introduction, 2004 edition, Dover Publications

Learning and Teaching Methods

The main objectives of the U.C. are to prepare students to develop control applications for non-linear systems, such as robotic, fluid, electronic/electrical, mechanical and biological. In order to achieve these objectives, sound knowledge of non-linear systems, stability verification methods, linearization methods, adaptive control methods and optimal control methods are required. All these subjects are addressed during the course.

Assessment Methods

For the assessment, students can choose one of two alternatives.

Alternative 1: Written test plus a group work:

The written test has a 50% weight in the final classification and the minimum grade is 7.00 points. The main subjects of the test are: Nonlinear Models and Nonlinear Phenomena; Second order systems; Lyapunov Stability; Input-Output Stability; and Feedback Linearization.

The group work has a 50% weight in the final classification and the minimum grade is 7.00 points. The main subjects of the group work are: Adaptive Control and Optimal Control.

Alternative 2: Final exam

The final exam has a 100% weight in the final classification and the minimum grade is 9.50 points.

The main subjects of the final exam are: Nonlinear Models and Nonlinear Phenomena; Second order systems; Lyapunov Stability; Input-Output Stability; Feedback Linearization; Adaptive Control; Optimal Control.