



Optimization and Control

ECTS: 6 ECTS

COORDINATOR: Jerónimo Rodríguez García (jeronimo.rodriguez@usc.es)

UNIVERSITY WHERE THE COORDINATOR IS: USC

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? Yes

LECTURER 1: Eva Balsa Canto

UNIVERSITY WHERE THE LECTURER 1 IS: Universidade de Vigo (UV)

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? Yes

LECTURER 2: Carlos Vilas Fernández

UNIVERSITY WHERE THE LECTURER 1 IS: UV

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? Yes

LECTURER 3: Miriam Rodríguez García

UNIVERSITY WHERE THE LECTURER 1 IS: UV

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? Yes

CONTENTS

Part I: Numerical Methods in Optimization

- Introduction (3h) – Practical examples with MATLAB
- Global and multi-objective optimization (3h) – Practical examples with MATLAB
- Optimization applied to mathematical modelling (3h)
- Practical case of industrial interest (3h)
- AMIGO2 software as a tool for dynamical systems optimization (9h)

Part II: Optimal Control

Chapter 5: Introduction (3h)

Chapter 6: Optimal control problems governed by discrete systems (4h)

Chapter 7: Optimal control problems governed by ordinary differential equations (8h)

Chapter 8: Optimal control problems governed by partial differential equations: elliptic and parabolic systems (6h)

METHODOLOGY

42 class hours where the contents are developed and some examples and exercises are solved. Through this methodology the competencies CG1, CG4, CG5, CE2, CE3, CE4, CE5 and CE6 are developed.

The work in the classroom should be completed with personal work in order to get a good understanding of the subject. Through this methodology the competencies CG1, CE4, CE5 and CE6 are developed.

LANGUAGE USED IN CLASS: Will depend on the audience.

IS IT COMPULSORY TO ATTEND CLASS? It is not compulsory.

BIBLIOGRAPHY

Optimization:

D. Bertsekas, Nonlinear Programming, Athena Scientific, 1999.

J. Nocedal - S.J. Wright, Numerical Optimization, Springer, 2006.

E. Walter & L. Pronzato, Identification of parametric models from experimental data. Springer, 1997.

Control:

E. Cerdá Tena, Optimización dinámica, Prentice Hall, 2001.

K. Ogata, Ingeniería de control moderna, Pearson-Prentice-Hall, 2010.

F.Tröltzsch, Optimal Control of Partial Differential Equations: Theory, Methods and Applications, AMS (Graduate Studies in Mathematics, Vol 112), 2010.

SKILLS

Basic:

CG1: To have knowledge that provide a basis or opportunity for originality in developing and / or applying ideas, often within a research context, knowing how to translate industrial needs in terms of R & D in the field of mathematics Industrial.

CG4: To have the ability to communicate the findings to specialist and non-specialist audiences in a clear and unambiguous way.

CG5: To have the appropriate learning skills to enable them to continue studying in a way that will be largely self-directed or autonomous, and also to be able to successfully undertake doctoral studies.

Specific:

CE2: To model specific ingredients and make appropriate simplifications in the model to facilitate their numerical treatment, maintaining the degree of accuracy, according to previous requirements.

CE3: To determine if a model of a process is well made and well mathematically formulated from a physical standpoint.

CE4: To be able to select a set of numerical techniques, languages and tools, appropriate to solve a mathematical model.

CE5: To be able to validate and interpret the results, comparing them with visualizations, experimental measurements and functional requirements of the physical engineering system.

CE6: To be able to extract, using different analytical techniques, qualitative as well as quantitative information of the models.

WILL YOU BE USING A VIRTUAL PLATFORM? Yes. Campus Virtual USC (Moodle).

WILL YOU BE USING ANY SPECIFIC SOFTWARE? **MATLAB** and **AMIGO2** toolbox

CRITERIA FOR THE 1ST ASSESSMENT OPPORTUNITY

The Optimization part and the Control part are evaluated separately and the average of both is done.

In the Optimization part the grade is the weighted average of the mark of the proposed project and the final exam. The latter will correspond to the grade obtained in the written exam made on the official date

or, in case the student does not attend this test, with the grade obtained in the partial eliminatory exam (during school hours). In case the students are not satisfied with that average or can not do the project, they can take the exam and the final grade in that case will be that of the exam.

The Control part will be evaluated only through the written exam on the official date.

The project: A report with the resolution of the problems must be presented. The corresponding programming will be carried out in different software packages. (CE4, CE5, CE6)

Final examination of the course. (CE2, CE3, CE4, CE5, CE6)

CRITERIA FOR THE 2ND ASSESSMENT OPPORTUNITY

The same as for the first assessment opportunity.
