Advance Scientific Calculus with MATLAB

ECTS: 6 ECTS

COORDINATOR: Carlos Martel Escobar (carlos.martel@upm.es)

UNIVERSITY WHERE THE COORDINATOR IS: UPM

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? No

SUBJECT CONTENTS

1) Nonlinear systems of equations. Newton's method. Continuation techniques.

2) ODEs: Boundary value problems. Shooting method. Continuation of steady solutions. Continuation of periodic solutions.

3) Sparse matrices. Definition and Operations. Factorization. Reordering. PDE discretization.

4) FFT. Definition. Spectral methods applied to PDEs.

5) Advanced visualization: 3D graphics, anumations.

METHODOLOGY

The main goal of this subject is to introduce the student to various advanced numerical computational techniques in various scientific and engineering branches. This is practice oriented subject. MATLAB is used to immediately apply the numerical techniques presented to practical examples (it is therefore essential for the students to be familiar with the use of MATLAB at a basic level). Evaluation is carried out through student activity in class and presentation of group work.

LANGUAGE USED IN CLASS: Will depend on the audience.

IS IT COMPULSORY TO ATTEND CLASS? Students can attend via conference system.

BIBLIOGRAPHY

* Y.A. Kuznetsov, "Elements of Applied Bifurcation Theory", Applied Mathematical Sciences 112, Springer-Verlag, 2004.

* T.S. Parker & L.O. Chua, "Practical Numerical Algorithms for Chaotic Systems", Springer-Verlag, 1989.

* H.B. Keller, "Numerical Solution of Two Point Boundary Value Problems", CBMS-NSF, Regional Conference Series in Applied Mathematics", 1990.

* C.G. Canuto, M.Y. Hussaini, A.M. Quarteroni, Th. A. Zang, "Spectral Methods in Fluid Mechanics", Springer-Verlag, 1990.

* "Using MATLAB", The MathWorks Inc., http://www.mathworks.com

SKILLS

Basic:

CG3: To be able to integrate knowledge in order to state opinions using information that even incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge.

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:

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

Numerical simulation specialization:

CS2: To adapt, modify and implement software tools for numerical simulation.

WILL YOU BE USING A VIRTUAL PLATFORM? Si. Moodle.

WILL YOU BE USING ANY SPECIFIC SOFTWARE? Yes. MATLAB

CRITERIA FOR THE 1ST ASSESSMENT OPPORTUNITY

The evaluation of the subject will take into account the student performance in class together with the elaboration of several essays in groups.

CRITERIA FOR THE 2ND ASSESSMENT OPPORTUNITY

The same as for the 1st assessment opportunity.