

Numerical Methods for Partial Differential Equations

ECTS: 6 ECTS

COORDINATOR: Generosa Fernández Manín (manin@dma.uvigo.es)

UNIVERSITY WHERE THE COORDINATOR IS: UVigo

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? Yes

LECTURER 1: Guillermo García Lomba (guille@dma.uvigo.es)

UNIVERSITY WHERE THE LECTURER 1 IS: UVigo

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? Yes

LECTURER 2: Laura Saavedra Lago (laura.saavedra@upm.es)

UNIVERSITY WHERE THE LECTURER 2 IS: UPM

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? Yes

SUBJECT CONTENTS

-Introduction to the numerical methods for the resolution of Differential Equations: finite differences, finite elements, finite volumes [3h].

-Methods of finite differences and finite elements in one dimensional problems [9h].

-Methods of finite differences and finite elements in several dimensions: elliptical, parabolic and hyperbolic problems [18h].

-Interactive classes using COMSOL-MULTIPHYSICS [12h].

METHODOLOGY

- Troubleshooting and / or exercises: the student has to resolve and deliver theoretical exercises of compression of the methods, practical of application to concrete problems and resolved with some software of numerical simulation: Matlab or Comsol Multiphysics.
- Practice in computer rooms: in the computer laboratory and using COMSOL Multiphysics resolve real cases simplified of diverse subjects: thermal, linear elasticity, electromagnetism, etc.
- Master sessions: these classes are devoted to explain the theoretical contents, to resolve some exercise to understand the methods and to introduce the practices of laboratory.

LANGUAGE USED IN CLASS: Spanish

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

BIBLIOGRAPHY

- LeVeque, R.J., Finite Difference Methods for Ordinary and Partial Differential Equations: Steady State and Time Dependent Problems, SIAM, 2007.
- Samarskii, A.A., The Theory of Difference Schemes, Marcel Dekker, New York, 2001.
- Strickwerda, J.C., Finite Difference Schemes and Partial Differential Equations, Chapman & Hall/CRC, Boca Raton, 1999.
- Reddy, J.N., An introduction to the Finite Element Method, 2ª y 3ª (1993 y 2006), Mc Graw Hill.
- Johnson, C., Numerical solution for partial differential equations, 2009, Dover publications
- Eriksson, K. Estep, D. Hansbo, P. Johnson, C., Computational differential equations, 1996, Cambridge.
- Class notes and COMSOL MULTIPHYSICS manuals.

SKILLS

Basic:

CG2: To be able to apply the acquired knowledge and abilities to solve problems in new or unfamiliar environments within broader contexts, including the ability to integrate multidisciplinary R & D in the business environment.

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:

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

Numerical simulation specialization:

CS1: To know, be able to select or use how to handle most suitable professional software tools (both commercial and free) for the simulation of processes in the industrial and business sector.

WILL YOU BE USING A VIRTUAL PLATFORM? Yes. fatic.uvigo.es

WILL YOU BE USING ANY SPECIFIC SOFTWARE? Yes. COMSOL MULTIPHYSICS

CRITERIA FOR THE 1ST ASSESSMENT OPPORTUNITY

Evaluation:

1. Attendance and class participation [5%].
2. Individual exercises [25%].
3. Two lab practices [30% all the same].
4. Compulsory final exam: theory (20%) and lab practices (20%).

CRITERIA FOR THE 2ND ASSESSMENT OPPORTUNITY

Students who had followed the continuous evaluation will hand in the individual exercises and redo the final exam.

Students who were not able to follow the continuous evaluation will take a final exam which will include all the contents of the subject. This exam will be taken with no help materials, will be longer than the 1st assessment opportunity one and will have a different structure.

FURTHER COMMENTS:

The COMSOL practices will take place at the University of Vigo for students enrolled in the Galician universities. For students enrolled in the universities in Madrid, these practices will take place in Madrid and will be taught by Laura Saavedra Lago and Fernando Varas Mérida.
