

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

SUBJECT CONTENTS

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

-Finite differences method and finite elements method in one dimensional problems (9h).

-Finite differences method and finite elements method in several dimensions: elliptical, parabolic and hyperbolic problems (18h).

-Practices with COMSOL-MULTIPHYSICS (12h).

METHODOLOGY AND COMPETENCE DEVELOPMENT

-Troubleshooting and / or exercises : the student has to resolve and deliver theoretical exercises of compression of the methods and applications to concrete problems. (CG5, CE4)

-Computer laboratory: the student using COMSOL Multiphysics solve some real cases simplified of diverse subjects: thermal, linear elasticity, electromagnetism, etc. (CG2, CG4, CG5,CE4,CS1)

-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. (CG2, CG4, CE5, CE4)

LANGUAGE USED IN CLASS: Spanish

IS IT COMPULSORY TO ATTEND CLASS? Students can attend via conference system in each university classroom, by internet and by access to recorded clases. It is compulsory to attend at laboratory classes and exams.

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. faitic.uvigo.es

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

CRITERIA FOR THE 1ST ASSESSMENT OPPORTUNITY - SKILLS EVALUATION

Continuous evaluation, first opportunity at the end of the semester,:

- Participation: solution of 5 telematic exercises (10%). (CG2, CG4)
 - The exercises delivered resolved. The deadline to deliver these exercises is the day of the examination, at the end of course (15%). (CG5, CE4)
 - Two practices of laboratory (30%). All of them with the same value. (CG2, CG4, CG5, CS1)
 - Final exam (theory 25% and practice 20%). (CE4,CS1)
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CRITERIA FOR THE 2ND ASSESSMENT OPPORTUNITY

Continuous evaluation: students can do the exercises (if they do not delivered them before) and they must to do the final exam.

Exceptional case: students who can not follow the continuous assessment may do a different final exam and they will be graded with the points obtained in the exam.

FURTHER COMMENTS:

The COMSOL practices (two days, morning and afternoon) will be taught at the University of Vigo for students enrolled in the Galician universities. Students enrolled in Madrid universities will perform these practices in Technical University of Madrid (UPM) and they will be supervised by teachers from that university.
