Professional Software in Electromagnetism and Optics

ECTS: 6 ECTS

COORDINATOR: Mª Dolores Gómez Pedreira (mdolores.gomez@usc.es)

UNIVERSITY WHERE THE COORDINATOR IS: USC

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? Yes

LECTURER 1: Mª Edita de Lorenzo Rodríguez (edita.delorenzo@uvigo.es)

UNIVERSITY WHERE THE LECTURER 1 IS: USC

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? Yes

LECTURER 2: Mª del Pilar Salgado Rodríguez (mpilar.salgado@usc.es)

UNIVERSITY WHERE THE LECTURER 2 IS: USC

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? Yes

SUBJECT CONTENTS

1. Introduction to the finite element method in electromagnetism.
    a. Different formulations of two and three dimensional electromagnetic models.
    b. Finite Lagrange and edge elements.
2. Description of FLUX2D.
    a. Introduction and description of the software.

b. Use of the package to solve various problems of electromagnetism: electrostatics, direct current, magnetostatics, alternating current,...

3. Introduction to a free software package in electromagnetism: MaxFEM

4. Introduction to the method of finite differences in electromagnetism.

5. Description of XFDTD software package.

a. Introduction and description of the software.

b. Use of the package to solve different problems: radiation, guided media, detection etc.

METHODOLOGY

The lessons will take place at the computer lab and will be treated as computer practices and seminars. The exercises to be carried out by the students will be described in some notes provided by the teachers.

LANGUAGE USED IN CLASS: Will depend on the audience.

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

BIBLIOGRAPHY

Basic bibliography:

FLUX2D User's guide.

A. Bermúdez, D. Gómez, P. Salgado, Mathematical models and numerical simulation in electromagnetism. Springer, 2014

XFDTD, Full Wave 3D Electromagnetic Analysis Software, Reference Manual, REMCOM.

C.A. Balanis, Antenna Theory: Analysis and Design. Wiley. 3ª ed, 2005.

Complementary bibliography:

A. Bossavit. Computational electromagnetism. Variational Formulations, Complementarity, Edge Elements. Academic Press. San Diego, CA, 1998.

K. Kunz, R. Luebbers, The Finite Difference Time Domain Method for Electromagnetics, CRC Press, 1993.

B.D. Popovic, Introductory Engineering Electromagnetics, Addison Wesley, 1971.

A.B. Reece and T.W. Preston, Finite Elements Methods in Electrical Power Engineering, Oxford University Press, Oxford, 2000.

P.P. Silvester and R.L. Ferrari, Finite Elements for Electrical Engineers, Cambridge University Press, Cambridge, 1996.

A. Taflove, S. C. Hagness, Computational Electrodynamics. The Finite-Difference Time-Domain Method. Artech House, 3ª edición, 2005.

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.

Specific:

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.

Numerical 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.

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

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

WILL YOU BE USING ANY SPECIFIC SOFTWARE? Yes. Flux2D

CRITERIA FOR THE 1ST ASSESSMENT OPPORTUNITY

A continuous assessment at the lab lessons will be done as well as a final exam.

The student evaluation will be based on continuous assessment of work done throughout the course (C) and a final exam (F) consisting on theory and practice.

The continuous assessment will be based on different jobs assigned to the students and corresponding to the different blocks of the course.

The final qualification will be 0.6*F + 0.4*C and will take into account that the part corresponding to XFDTD will represent 1/3 and the part of Flux2D will represent 2/3 of the total mark.

To pass the course the student should obtain at least 3 points (over 10) in the part of XFDTD and 4 points (over 10) in the part of Flux2D.

The qualifications associated to the continuous assessment (C) will be communicated to the students before the exam.

CRITERIA FOR THE 2ND ASSESSMENT OPPORTUNITY

The evaluation will be done by using the same procedure of the first period: 0.6*F + 0.4*C, where C is the mark obtained in the first period.

If for duly justified exceptional reasons, a student could not follow the continuous assessment, he/she will have a single test of all the contents of the course.