27030 - Numerical Treatment of Partial Differential Equations

Syllabus Information

Academic year: 2023/24
Subject: 27030 - Numerical Treatment of Partial Differential Equations
Faculty / School: 100 - Facultad de Ciencias
Degree: 453 - Degree in Mathematics
ECTS: 6.0
Year: 4
Semester: Second semester
Subject type: Optional
Module:

1. General information

The aim of this subject is to introduce students to numerical methods for solving partial differential equations. They will study finite difference methods as well as finite element methods.

The approaches and objectives of this module are aligned with the Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda; the learning activities could contribute to some extent to the achievement of the goals 4 (quality education), 5 (gender equality), 8 (decent work and economic growth), and 10 (reducing inequality).

2. Learning results

- Get to know the basic methods for approximating partial differential equations, and the implementation of the corresponding algorithms for such problems.
- Numerically approximate the solution of partial differential equations' problems, and estimate the error provided by these approximations.
- Understand the advantages and limitations of each of the numerical methods for their optimal application.

3. Syllabus

1. The finite difference method for one-dimensional boundary value problems.
2. The finite difference method for elliptic equations.
3. Solution of large systems of equations. The preconditioned conjugate gradient method and the multigrid method.
4. The finite difference method for parabolic problems.
5. The finite element method for one-dimensional boundary value problems.
6. The finite element method for elliptic equations.
7. Implementation of the methods and numerical simulation.

4. Academic activities

Master classes: 30 hours.
Problem solving: 15 hours.
Computer classes: 15 hours.
Project: 25 hours.
Study: 60 hours.
Assessment tests: 5 hours.

5. Assessment system

- Individual delivery of a collection of solved theoretical and practical problems that have been assigned and/or proposed in class. Oral examination of a duration of 30 minutes on the exercises and practices carried out. The mark of this part will represent 80% of the final grade.
- Realization of a course-work based on the implementation of the numerical methods studied in class to a model based on partial differential equations. Oral presentation and defense of the previous work. The qualification of this part will represent 20% of the final grade.

Without prejudice to the right that, according to current regulations, assists the student to pass the subject by taking a global exam.