Numerical modelling of structural elements

Academic Year: (2020 / 2021) **Review date: 13/07/2020 13:46:27**

Department assigned to the subject: Continuum Mechanics and Structural Analysis Department

Coordinating teacher: ZAERA POLO, RAMON EULALIO

Type: Electives ECTS Credits : 3.0

Year : 4 Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

-Mechanics of Structures
-Elasticity and Strength of Materials

OBJECTIVES

The student will learn the background needed to analyse engineering problems in structural mechanics by means of simulations based on the Finite Element Method (FEM). The student achieves this background with the development of their own programming codes with Matlab. The starting level of knowledge for Matlab (or other programming language) to attend the subject is basic level.

In this context, several numerical techniques will be described, which allows the simulation of the behavior of trusses, beams, plates, shells among others, and also of more complex structures built by combination of the affore mentioned element types. Students will learns to solve the following mechanical problems: stress analysis of a plate with a hole, mode analysis of beam structures and wave propagation on membranes.

These knowledge will allow the student to correctly identify the parameters of a structural problem, to establish simplifications (if possible), to implement a computational solution procedure and to perform a critical analysis of the results.

DESCRIPTION OF CONTENTS: PROGRAMME

- Fundamental concepts. Rayleigh-Ritz method. Finite Element method.
- Application to structures: truss and beam finite elements.
- Application to two- and three-dimensional problems: triangle, quadrilateral and brick finite elements.
- Pre-processing and modeling techniques: selection of the element, meshing, symmetries, boundary conditions.
- Post-processing and analysis of results.

LEARNING ACTIVITIES AND METHODOLOGY

-- 50% of theory lessons: learn the methodologies to solve mechanical problems with the Finite Element Method.
-- 50% of computer lessons: develop programming codes to solve mechanical problems with the Finite Element Method.

-- Tutorials and personal work of the student; oriented to the acquisition of practical skills related to the program of the subject.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

-- Continuous Evaluation based on a number of deliverable programming codes of practical works done by groups. The average qualification obtained amounts for 50% of the final qualification of the course.

% end-of-term-examination/test:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

-- Final exam at the end of the semester. It amounts for 50% of the final qualification of the course.

BASIC BIBLIOGRAPHY

- P.M. Kurowski Finite Element Analysis For Design Engineers, SAE International, 2004

- T.R. Chandrupatla, A.D. Belegundu Introduction to Finite elements in Engineering, Prentice Hall, 1991

ADDITIONAL BIBLIOGRAPHY

- E. Oñate Cálculo de Estructuras por el Método de los Elementos Finitos. Análisis Estático Lineal, CIMNE, 1995

- O.C. Zienkiewicz, R.L. Taylor, J.Z. Zhu El Método de los Elementos Finitos. Vol 1, Las Bases, CIMNE, 2010

- S. S. Quek, G.R. Liu The Finite Element Method: A Practical Course, Butterworth-Heinemann, 2003