

66423 - Methods of analysis for structural mechanics

Syllabus Information

Academic year: 2023/24

Subject: 66423 - Methods of analysis for structural mechanics

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 536 - Master's in Mechanical Engineering

ECTS: 6.0

Year: 1

Semester: First semester

Subject type: Compulsory

Module:

1. General information

Objectives of the subject

The objective of the subject is to train the student in the application of numerical and experimental techniques to evaluate the structural behaviour of parts and components in order to improve their mechanical performance. It focuses on computational and experimental methods for the calculation, design, and experimental analysis of the mechanical behaviour of parts, components, and structures subjected to static and dynamic loads, with the aim of improving their resistance or extending their life cycle. In this context, experimental techniques are used for the evaluation of the system, in addition to applying specific computational simulation techniques to predict its structural behaviour. The main areas of application are: structural dynamics, vibrations, fatigue, fracture, residual stresses and material behaviour laws.

Sustainable Development Goals of the 2030 Agenda (<https://www.un.org/sustainabledevelopment/es/>): Goal 7: Objective 7.3; Goal 9: Objectives 9.1 and 9.4; Goal 12: Objective 12.5

Recommendations to take the subject.

It is important to have knowledge in strength of materials and structural theory.

2. Learning results

1. To acquire skills for the design of mechanical and structural elements.
2. To acquire the practical skills for the application of experimental testing methods and numerical simulation of the behaviour of parts, mechanical components and structural elements.
3. To assimilate the comprehensive methodologies of structural design in mechanical components and structural elements through numerical-experimental techniques.

3. Syllabus

Topics

Block I. Computational methods

1. Computational tools for mesh processing.
2. Computational tools based on the finite element method.
3. Computational tools for structural analysis in building.

Block II. Experimental techniques

1. Measurement of residual stresses in parts using strain gauging.
2. Universal testing machines. Characterization of materials.
3. Experimental simulation of the real behaviour of mechanical prototypes.

Laboratory practices

1. Computational analysis techniques of stress states in mechanical components and structural elements.
2. Computational simulation of material behaviour through the constitutive laws of materials.
3. Experimental characterization of the mechanical properties of different materials using universal testing machines.
4. Experimental techniques to measure residual stresses in parts using strain gauging.

4. Academic activities

The subject has been designed with the aim of guiding the student to develop continuous work throughout the term, and to be able to know and control the evolution of their learning process. It is advisable for the student to use the tutoring hours or send

the teacher an email when they detect certain deficiencies in the evolution of their learning.

Among other activities, the student will have to study several real cases that the teacher will propose. These tasks may be done individually or in pairs, depending on the number of students. Students will have to analyse these cases, including the numerical-experimental correlation of a real case, and search for the additional information necessary for their complete understanding. Students will prepare a report for each assigned task and will hand it in to the teacher. These works will be orally defended before the subject's teachers and the rest of the students.

- Master classes and problems. (30 hours)
- Laboratory practices. (30 hours)
- Study and personal work. In this non-attendance part each student must dedicate, at least, about 82 hours, which are necessary for the study of theory, production of works and drafting of practice reports.
- Assessment (3 hours)

5. Assessment system

The subject is preferably evaluated with a **continuous assessment** that consists of three blocks:

- 1.- Written tests (20% of the final grade)
- 2.- Tutored Works (60% of the final grade)
- 3.- Oral presentations and debates (20% of the final grade)

Alternatively, the student has the possibility of passing the subject by means of the **global evaluation** in the official calls for exams. Knowledge will be assessed through a theoretical-practical test on the dates established by the centre.