

69710 - Biomechanical modeling of the cardiovascular system

Syllabus Information

Academic year: 2023/24

Subject: 69710 - Biomechanical modeling of the cardiovascular system

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 633 - Master's Degree in Biomedical Engineering

ECTS: 3.0

Year:

Semester: Second semester

Subject type: Optional

Module:

1. General information

The objective of the subject is to provide the student with the necessary skills to make simple models that allow the reproduction of the main characteristics of the cardiovascular system.

The subject focuses on providing the student with the basic tools in computational simulation to reproduce the functional behaviour of different components of the system, such as blood vessels, heart or blood flow. Finally, some situations of clinical interest will be presented, such as pathology modelling, tissue interaction with intravascular devices.

The objectives are aligned with the Sustainable Development Goals:

Goal 3: Ensure Healthy Lives and Promote Wellness for All at All Ages. Objective 3.4

Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. Objective 9.5

2. Learning results

- To know the main characteristics that define the mechanical behaviour of the tissues of the cardiovascular system.
- To identify the mathematical models of behaviour (elastic, hyperelastic, inelastic, etc.) that best reproduce the properties of each type of tissue (heart, arteries and veins), as well as the behaviour of blood.
- To know how to apply numerical methodologies to model the behaviour of the different biological structures that compose the cardiovascular system.
- To be able to apply numerical methodologies to analyse and model blood flow and its interaction with vessels and the heart.
- To know how to apply numerical methodologies to analyse and study the interaction of the cardiovascular system with medical devices and implants.

3. Syllabus

1: Introduction

2: Composition, structure and functionality of tissues of the cardiovascular system.

3: Elastic models of cardiovascular tissue behaviour.

4: Inelastic models of cardiovascular tissue behaviour.

5: Blood flow modelling.

6: Modelling of adaptive and degenerative processes in pathologies of the cardiovascular system.

7: Interaction of devices and implants with the cardiovascular system.

4. Academic activities

Theoretical classes. Presentation by the teacher of the main contents of the subject.

Practical sessions. There will be several practical sessions, with a series of activities to be performed in them. A duly completed report must be submitted upon completion of the practical sessions.

Application or research work. Application of the knowledge presented in the subject. It must be presented orally to the rest of the students in Spanish or English.

Tutoring. Personalized attention for students.

Assessment Set of theoretical-practical written tests and presentation of reports or papers used in the evaluation of the student's progress.

5. Assessment system

Continuous assessment:

Final exam (40%).

The test will consist of several theoretical and practical questions. The student must obtain a minimum total grade of 4 out of 10

points.

Tutored practical work (30%).

The evaluation of the tutored work proposed throughout the two-month period will take into account the suitability and originality of the proposed solution, the relation with the concepts learned in class, as well as the oral presentation. The student must obtain a minimum total grade of 4 points out of 10.

Practical sessions (30%).

The assessment of the practical sessions will be done through the reports presented after them, as well as the work done in the laboratory or computer lab. The student must obtain a minimum total grade of 4 out of 10 points.

Global assessment:

In the case of students who opt for the global evaluation, both in the first and second call, the written exam will include questions from the theoretical part with a value of 70% and from the practical sessions, whose final value will be 30%.

The second call will be evaluated by means of a global assessment.