

Physical modeling and Numerical simulation of microsystems

Number of ECTS credits: 3
Coefficient: 3

Description:

The general aim of the module is the discovery and practice of physical modeling and Numerical simulation of microsystems.

The courses are devoted to a summary of the principal equations involved in Microsystems, in the form of partial differential equations whose solution is determined by the boundary conditions.

The tutorials cover the application of theory to concrete cases:

1. Vibration and analysis of the modes of vibration of structures;
2. Propagation of acoustic waves;
3. Concrete problems of electrostatics and simulation of electronic components;
4. Propagation of heat in Microsystems;
5. Various couplings: piezoelectricity, acoustic-elastic coupling, electrostatic actuation. The software used for tutorials is Comsol Multiphysics.

The labs aim to learn programming using an advanced language of finite element simulations, with the aim of designing and optimizing Microsystems. For this purpose, the labs will use the command of the libraries of Comsol by Matlab.

Pedagogical objectives:

Understand the finite element method

Know how to apply it to the fundamental equations of the mechanics of solids, acoustics, electrostatics, the equation of heat

Understanding multiphysical coupling

Learning to solve specific cases of Microsystems

Learning to use finite element software adapted to multiphysical digital simulation, Comsol Multiphysics

Learn to pair this software with Matlab

Bibliography: Prerequisite:

Basic knowledge of analysis; Notion of multivariate integral; Understanding the fundamental equations of physics

(mechanics, acoustics, electrostatics, propagation of heat).

Lectures Hours: 5

Tutorials Hours: 16

Labs Hours: 8

Knowledge monitoring modalities: 100% continuous assessment

Assessment: Reports of labs

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