EPFL

MICRO-402   **Modeling and simulation of microsystems**

Quack Niels, Shea Herbert

Cursus	Sem.	Type
Microtechnics	MA1, MA3	Obl.
Microtechnics	MA1, MA3	Opt.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	Oral
Workload	90h
Weeks	14
Hours	**3 weekly**
Courses	1 weekly
Exercises	2 weekly
Number of positions	

Summary

Students will learn how to analyze a problem, identify the relevant parameters, build a simple model and/or a more complex discretized problem, solve it using computing power and extract the relevant parameters from the simulation.

Content

Part 1. 1 degree of freedom system
- Static deformation of a spring-mass
- Dynamic deformation
- Dynamic deformation with a non sinusoidal drive
- Dynamic deformation with a non-linear stiffness

Part 2. Lump model & Equivalent circuit

- Mechanical resonator
- Electro-mechanical resonator
- Thermal conductance

Part 3. Finite Element Modelling
- Static mechanical deformation
- Surface stress effects on micro-structures
- Thermal simulation
- Electrothermal simulation
- Electro-thermo-mechanical simulation

Keywords

Simulation, Modelling, Finite element, Runge-Kutta, Mesh, Convergence, Multi-physics

Learning Prerequisites

Required courses

Basic electronics and physics

Important concepts to start the course

Learning Outcomes

By the end of the course, the student must be able to:
- Choose the appropriate approach to modelling a simple device
- Identify relevant parameters in a system
- Design the model describing the system
- Interpret predictions and results from the model
- Choose the appropriate boundary conditions
- Choose the appropriate mesh size with respects to the physics of the problem

Teaching methods

Ex-Cathedra
Exercises on a computer using Matlab, QUCS and a FEM software
Project work in small groups

Expected student activities

Assessment methods

Oral exam - 50%
Project - 50%

Supervision

Office hours	Yes
Assistants	No
Forum	No
Others	