MICRO-606 **Scaling in MEMS**

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Cursus	Sem.	Type
Advanced Manufacturing		Opt.
Microsystems and Microelectronics		Opt.

Language of teaching	English
Credits	1
Session	
Exam	Oral presentation
Workload	30h
Hours	**14**
Courses	14
Number of positions	**16**

Frequency

Every 2 years

Remark

Next time: Summer 2027

Summary

This doctoral class covers the scaling of MEMS devices, including mechanical, thermal, electrostatic, electromagnetic, and microfluidic aspects.

Content

- Introduction to scaling laws: scaling of classical mechanical systems, scaling of classical electrical systems, breakdown in scaling, quantum breakdown.
- Thermal effects: conduction, convection, dynamics, breakdown, thermal micro-actuators, microreactors.
- Mechanical devices: mass-spring model, mechanical noise, squeeze film effects.
- Electrical devices: electrostatic micro-actuators, electrostatic breakdown, tunnel sensors, coils and inductors, electromagnetic micro-actuators, magnetostriction, magnetic beads.
- Microfluidics: liquid flow, gas flow, diffusion-mixing, surface tension, entropy trapping.
- Electrokinetics: dielectrophresis, EHD and MHD pumps, electrowetting, electroosmosis, capillary electrophoresis.

Keywords

Scaling laws, thermal micro-actuators, electromagnetic micro-actuators, microfluidics, electrokinetics

Learning Prerequisites

Recommended courses

- and/or microsystems and MEMS technologies
- Basics of physics

Learning Outcomes

By the end of the course, the student must be able to:

Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Use a work methodology appropriate to the task.
- Communicate effectively with professionals from other disciplines.
- Give feedback (critique) in an appropriate fashion.
- Demonstrate the capacity for critical thinking
- Access and evaluate appropriate sources of information.
- Make an oral presentation.

Assessment methods

in-class presentation