FEI3310 Metasurfaces: Theory and Practice, PhD course 10.0 credits

Meta-ytor: Teori och praktik, doktorandkurs

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for FEI3310 valid from Autumn 2015

Grading scale

G

Education cycle

Third cycle

Specific prerequisites

The course requires advance knowledge of electromagnetism, and it is desirable to have knowledge about radiofrequency technologies. Students who hold an MSc degree in Telecommunication Engineering, Electrical or Electronic Engineering or Physics should have the basis to meet the requirements of this course.

Furthermore, basic knowledge of antennas and/or microwave devices is an asset. If the student has already passed a Masters and/or PhD course on electromagnetic fields, antennas, microwaves, and optics, he/she should be in the ideal condition to follow the lectures.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After the course, the students should be able to:

- Describe a metasurface; explain the types of metasurfaces; and identify their limitations and properties.
- Develop analytic models to characterize canonical metasurfaces and periodic structures.
- Describe the operation of specific metasurfaces via in-house computational codes they develop.
- Choose the appropriate type of metasurface for a particular application.
- Analyze the operation of metasurfaces with commercial software.
- Design basic metasurface structures with commercial software.
- Develop an advanced microwave circuit or antenna that makes use of metasurfaces.

Course contents

Metasurfaces, classic electromagnetic field theory, physical optics, microwave devices, advanced antennas, metamaterials.

Disposition

Theory lessons: 75h.

The course will be composed of 5 intensive weeks of lectures and home assigments:

- Each week will be dedicated to a specific topic in which a Professor, or someone who is in other ways expert in the field, will lead the educational process.
- Each week will have 15hours of lectures. 3 hours/day.
- After the lectures, each day, the students will be have to work on home assigments and deliver their results to the teacher in charge.

After the lectured part of the course, the student develops an individual project that is equivalent to 2 weeks of full work.

Course literature

Books:

- “The Plane Wave Spectrum Representation of Electromagnetic Fields”, P.C. Clemmow, IEEE Press.

- "Electromagnetic Wave Propagation, Radiation, and Scattering", Akira Ishimaru. Prentice Hall, 1991.
- "Geometry and Light: The Science of Invisibility", Ulf Leonhardt, Thomas Philbin, Dover, 1st Edition.

Article and notes will be provided during the lessons.

Equipment

The students will use the computers of the laboratory offered by the Electromagnetic Department. These computers will offer access to simulation software CST Microwave Studio, and Matlab.

- CST Microwave Studio is commercial software which enables the simulation of metasurfaces, antennas and electromagnetic devices.
- Matlab will be employed for the development of short scripts to simulate the operation of metasurfaces.

Examination

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Students must attend the 5 weeks of lectures. Exercises and homework that are handed out during the lectures are mandatory to do and hand in.

Each week will have a different educational leader.

Students must attend and participate in the most of the lectures (90% of attendance is mandatory). They must complete all the exercises given to them on the lectures, deliver the required reports and respect deadlines.

Other requirements for final grade

During the active 5 weeks of the course, there will be home-assignments, including exercises and development of simulation codes. The students must report and deliver all the assignments on time.

Hand in a written report and make an oral presentation of a proposed final project.

The teachers will evaluate the assignments and the final project. All the assignments (including the final project) must be passed, in order to pass the course. The final grade of the course will be Passed/No Passed.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.