EI2420 Electromagnetic Wave Propagation 7.5 credits

Elektromagnetisk vågutbredning

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

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

Establishment

Course syllabus for EI2420 valid from Spring 2019

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

150 university credits (hp) in engineering or natural sciences including electromagnetic theory corresponding to the courses EI1200 and EI1210, or instead the course EI1240, and documented proficiency in English corresponding to English B.

Language of instruction

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

Intended learning outcomes

When the students have passed the course, they shall be able to:

- Use Greens function for integral representations of electromagnetic field in external and integral regions of arbitrary shape.
- Explain estimates and approximations when using integral representations for electromagnetic fields.
- Relate fields to sources
- Choose method to solve an integral equation in some type cases.
- Use the equivalence principle for currents to represent electromagnetic fields
- To construct approximation and to motivate them when solving the fields from a reflector antenna.
- Numerical calculate current distribution, scattering and/or reflection and transmission coefficient for three standard cases: wire antenna, coated sphere, antenna over a ground plane.
- Represent the radiating field with the electromagnetic multipoles.
- Know and use the approximations of Geometric optics and Physical optics
- Calculate the radar cross section
- Analyze a dipole over a conducting plane
- Use steepest decent, stationary phase, saddle point method to approximate integral representations of fields and to choose which to use at a given situation
- Solve problems with the zero field method, and to know off, and use the properties of the T-matrix
- Derive the integral equations in time domain. Be aware of the similarities and differences of integral equations in transient and time harmonic cases.
- Write detailed reports with motivations for calculations and explanations of simulation results.

Course contents

Lectures

The lectures are taken after the book Ström & Jonsson. The course treat scattering of fields for arbitrary geometries. Integral equations and representations for the electromagnetic field. Multipoles. One important part which appears throughout the course is to derive estimates and approximations to the given results. We treat reflector antennas, scatterers and a simple model for the influence of the ground plane on an antenna. This course is an advanced course and prepares both for working with radiating electromagnetic fields as well as a first course preparing for research in this field. The book connects to current result in the literature.

Exercises:

Exercises on some of the important items in the course.

Course literature

S. Ström and L. Jonsson, Electromagnetic Wave Propagation

Examination

- TEN1 - Examination, 7.5 credits, grading scale: A, B, C, D, E, FX, F

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.

Other requirements for final grade

Three larger homework. Verbal examination.

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.