FSK3340 Fourieroptik 6,0 hp

Fourier Optics

När kurs inte längre ges har student möjlighet att examineras under ytterligare två läsår.

Fastställande

Kursplan för FSK3340 gäller från och med VT10

Betygsskala

Utbildningsnivå

Forskarnivå

Särskild behörighet

Knowledge of the physics of electromagnetic radiation corresponding to SK2110 (Waves, 6 hp) and in basic mathematics (vector analysis, integrals, differential equations) is a prereq-uisite. Moreover, knowledge in optics corresponding to SK2300 (Optical physics, 6 hp) is of advantage, but not mandatory. Basic knowledge of programming in MATLAB is highly recommended, but maybe acquired during the course if the examiner had agreed to it in advance.

Language of instruction: English only

Undervisningsspråk

Undervisningsspråk anges i kurstillfällesinformationen i kurs- och programkatalogen.

Lärandemål

The overall aim of the course is that you should be able to analyze optical problems with the help of the approximations made in Fourier optics and develop simple numerical simulations for your systems.

This means that you should be able to:

- Describe the mathematical characteristics of the two dimensional Fourier transform and explain their relevance for the analysis of linear optical systems
- Explain the basics of scalar diffraction theory
- Analyze different solution methods for the Helmholtz equation
- Apply the Fresnel and Fraunhofer approximation to calculate the diffraction patterns of standard optical components
- Reflect on the physical implications of diffraction and their influence on the resolution in optical imaging systems
- Develop and implement algorithms for numerical wavefield propagation

Kursinnehåll

The course will follow chapters 2-6 of the book with an additional part on wave-propagation methods:
- Analysis of two-dimensional signals and systems

- Foundations of scalar diffraction theory

- Fresnel and Fraunhofer diffraction

- Wave-optics analysis of coherent systems

- Frequency analysis of optical imaging systems

- Numerical methods for wave-field propagation:

  - Fresnel-Kirchhoff diffraction formalism

  - Fresnel propagation

  - Fraunhofer propagation

  - Example for techniques beyond Fourier optics: Finite-difference method

Kursupplägg

The lectures will be given by the students on one or part of the above topics. The length of one lecture is two hours. The number of lectures and their specific content will be adjusted to the number of participants. Additionally, the students have to implement examples of the above mentioned numerical methods using the computer program MATLAB. The programs will be evaluated using a peer-review scheme.

Kurslitteratur

Joseph W. Goodman, Introduction to Fourier Optics, Third edition (2005), Roberts and Company publishers.

One of the best books in optical physics, suitable both for self-study and reference

Examination

Examinator beslutar, baserat på rekommendation från KTH:s handläggare av stöd till studenter med funktionsnedsättning, om eventuell anpassad examination för studenter med dokumenterad, varaktig funktionsnedsättning.

Examinator får medge annan examinationsform vid omexamination av enstaka studenter.

The course grading is P(pass) and F(fail). The examination consists of two parts:

Part 1: Lecture given by the students on one part of the course content (RED1, 3hp)

Part 2: Homework problems: Numerical simulations on wave propagation (INL1, 3hp)

To pass the course, you have to attend at least 80% of the lectures. If this is not possible, you will be given an extra written assignment about the content of the missed lectures.

Etiskt förhållningssätt

- Vid grupparbete har alla i gruppen ansvar för gruppens arbete.
- Vid examination ska varje student ärligt redovisa hjälp som erhållits och källor som använts.
- Vid muntlig examination ska varje student kunna redogöra för hela uppgiften och hela lösningen.