SH2310 Strålningsdetektorer och medicinska bildgivande system 7,5 hp

Radiation Detectors and Medical Imaging Systems

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

Fastställande

Kursplan för SH2310 gäller från och med VT16

Betygsskala

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

Utbildningsnivå

Avancerad nivå

Huvudområden

Fysik

Särskild behörighet

Bachelor's degree in Engineering Physics, Electrical Engineering, Computer Science or equivalent.

Undervisningsspråk

Undervisningsspråk anges i kurstillfällesinformationen i kurs- och programkatalogen.

Lärandemål

After completion of the course, the student should be able to:

- Explain the physical and technological principles behind various types of radiation detectors and imaging modalities.
- Use the signals and systems approach to describe and estimate the quality of an imaging system.
- Display understanding of the Fourier space representation of images.
- Use the physics of radiation absorption and generation together with the geometries of the different imaging modalities to solve numerical problems.
- Perform image reconstruction for Computed Tomography in simple cases and understand the sinogram representation of images.
- The student is required to use a mathematical programming language such as MATLAB for the hand-ins and laboratory work.
- To qualify for the highest grades, the student should also demonstrate the ability to:
- Identify physical and current technological limitations of medical imaging systems.
- Apply knowledge from imaging modalities within the course content on novel imaging techniques.
- Solve medical imaging problems that relate to statistics and probability theory.
- Show understanding of the connection between the image quality metrics (e.g. PSF, MTF, NPS, SNR) and the final image.

Kursinnehåll

The course treats the physical, mathematical and technological aspects of medical imaging systems from a signals-and-systems point of view. Modalities (imaging types) covered include:

- Projection Radiography
- Computed tomography (CT)
- Planar Scintigraphy
- Single photon emission computed tomography (SPECT)
- Positron emission tomography (PET)
- Ultrasound imaging (briefly)
- Magnetic resonance imaging (MRI) (briefly)

Numerical methods to quantify the performance of medical imaging systems are presented. The design of medical imaging systems usually involves a number of tradeoffs involving parameters such as: contrast, spatial resolution, noise, image acquisition time, size and cost. It is a major goal of the course to provide an understanding of these relations.

Kurslitteratur

Jerry L. Prince, Jonathan M. Links, "Medical Imaging Signals and Systems", 1st Edition (2009) or 2nd Edition (2014)

Examination

- LAB1 - Laborationer, studiebesök, 3,0 hp, betygsskala: P, F
- TEN1 - Tentamen, 4,5 hp, betygsskala: A, B, C, D, E, FX, F

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.

Övriga krav för slutbetyg

One written exam (TEN1; 4,5 university credits) and laboratory work, including compulsory participation in visits at Hospital (LAB1; 3 university credits). Hand-in assignments during the course give bonus points for the written exam.

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.