CM2014 Simulation Methods in Medical Engineering 7.5 credits

Simuleringsmetoder i medicinsk teknik

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

Establishment

Course syllabus for CM2014 valid from Spring 2025

Grading scale

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

Education cycle

Second cycle

Main field of study

Medical Engineering

Specific prerequisites

Completed degree project 15 credits, 15 credits mathematics, 5 credits computer science or programming. English B/6.

Language of instruction

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

Intended learning outcomes

After passing the course, the student should be able to

- Understand the rationale behind medical simulations and what societal challenges could be solved with medical simulations
- Describe the key concepts and theoretical background in medical simulations
- Derive and explain some fundamental mathematical models in medical simulations
- Solve basic differential equations (analytically and numerically) of relevance in medical simulations
- Critically analyze and discuss the plausibility of the simulation results

Course contents

Modeling and simulation play an important role and have developed into indispensable disciplines in many fields, including Medical Engineering. This course aims at providing a comprehensive introduction to the methods and theory of medical simulations, covering the following topics:

Finite element methods (FEM) for biomechanics simulations

Medical imaging simulation methods (ultrasound and ionizing radiation imaging)

Methods that have applications in mechanistic modeling of disease, treatment, epidemiology, healthcare systems and processes, logistics etc., including

- Systems dynamic modeling and simulation
- Discrete event simulations
- Agent-based modeling

Molecular simulations

CFD (Computational fluid dynamics) for fluid and climate technology

Surgical and haptic simulations

Despite different simulation methods, all have mathematics behind, and an understanding of differential equations is warranted

Examination

- TEN1 - Written exam, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory work, 4.5 credits, grading scale: P, 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.

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

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.