MJ2515 Numerical Heat Transfer in Energy Technology 3.0 credits

Numerisk värmeöverföring i energiteknik

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

On 15/10/2021, the Dean of the ITM school has decided establish this official course syllabus to apply from spring term 2023, registration number: M-2021-2020.

Grading scale

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

Education cycle

Second cycle

Main field of study

Mechanical Engineering

Specific prerequisites

Documented knowledge in the following subjects: Heat transfer, 6 credits, equivalent to contents of MJ1401; Fluid mechanics, 6 credits, equivalent to contents of SG1220; programming in Matlab, Python or the like

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:

1. Describe numerical methods for handling of partial differential equations and derive specific relationships for programming
2. Define governing equations for relevant heat transfer processes and design representative numerical simulations
3. Analyse simulation results, considering validity, precision and numerical stability

Course contents

The general aim of the course is to give a solid background about numerical methods that are relevant to heat transfer and flow for applications in the energy field with an emphasis on design of components. Participants that complete the course will have sufficient prior knowledge for following studies where commercial numerical calculation tools (CFD codes) are used. The following subject is treated in the course:

- Numerical solutions to differential equations
- Error analysis in numerical methods
- Basic equations for heat transfer in solid materials
- Basic for flow: the preservation of mass, momentum and energy
- The finite difference method for 1D and 2D heat transfer
- Euler's solution method for transient heat transfer
- Stability criteria for explicitly time-marching solutions
- Advection equation and relevance to convective heat transfer
- Implicitly time-marching solutions for advection
- Introduction to Navier-Stokes equations and turbulence and their numerical treatment

Examination

- INLA - Home assignment, 0.5 credits, grading scale: P, F
- INLB - Home assignment, 0.5 credits, grading scale: P, F
- TEN1 - Written exam, 2.0 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.

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.