MJ2444 Theory and Practice of Computational Methods in Energy Technology 7.5 credits

Teori och praktik av numeriska beräkningsmetoder inom 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

Course syllabus for MJ2444 valid from Spring 2017

Grading scale

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

Education cycle

Second cycle

Main field of study

Mechanical Engineering

Specific prerequisites

- MJ1401 Heat Transfer, or equivalent
- SG1220 Fluid Mechanics for Engineers, or equivalent

Language of instruction

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

Intended learning outcomes

The objective of this course is to introduce the participants to numerical methods, models and strategies in energy technical processes as well as efficient simulation tools.

After completing the course the student should be able to:

- Identify mathematical problemssuch as elliptic, parabolic and hyperbolic problems etc.
- Select appropriate numerical and iterative methods for treatment of the given problem such as the finite element method and control volume method
- Justify the choice of solution method (algorithm, scheme, etc.) as well as argue for adoption (advantages, disadvantages and limitations);
- Apply the correct numerical models and related boundary conditions;
- Deal with practical issues such as the delimitation of the problem, geometry definition, mesh type, global and local mesh density, mesh combination and mesh-independent analysis;
- Present the results in a relevant and illustrative manner (visualization) and reliably make assessment of results;
- Present the results through proper use of terminology
- Use special features of programming language, which is designed for the simulation tool

Course contents

- Basic Philosophy of CFD.
- Governing Equations of Fluid Dynamics.
- Incompressible Inviscid Flows: Mathematical Properties of the Fluid Dynamics Equations.Discretization of Partial Differential Equations.Transformations and Grids.
- Explicit Finite Difference Methods: Selected Applications to Inviscid and Viscous Flows. Boundary Layer Equations and Methods of Solution.
- Implicit Time-Dependent Methods for Inviscid and Viscous Compressible Flows, Discussion of the Concept of Numerical Dissipation.Finite Volume Methods in Computational Fluid Dynamics.Aspects of CFD Computations with Commercial Packages.

Course literature

1. An Introduction to Computational Fluid Dynamics

The Finite Volume Method, 2nd Edition, H. Versteeg, W. Malalasekera

Feb 2007, Paperback, 520 pages

ISBN13: 9780131274983

ISBN10: 0131274988

2. Computational fluid dynamics [electronic resource] : an introduction

John F. Wendt (ed.). ; with contributions by John D. Anderson, Jr. ... [et al.].

Language:English. Edition:3

Imprint:Berlin ; [London] : Springer, 2008.

1. An Introduction to Computational Fluid Dynamics

The Finite Volume Method, 2nd Edition, H. Versteeg, W. Malalasekera

Feb 2007, Paperback, 520 pages

ISBN13: 9780131274983

ISBN10: 0131274988

2. Computational fluid dynamics [electronic resource] : an introduction

John F. Wendt (ed.). ; with contributions by John D. Anderson, Jr. ... [et al.].

Language:English.

Edition:3

Imprint:Berlin ; [London] : Springer, 2008.

Examination

- LAB1 - Laboratory work, 4.5 credits, grading scale: P, F
- TEN1 - Written exam, 3.0 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.

Other requirements for final grade

- Exam (TEN1)
- Project (LAB1)

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.