SG2223 Fluid Mechanics 9.0 credits

Strömningsmekanik

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 SG2223 valid from Autumn 2007

Grading scale

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

Education cycle

Second cycle

Main field of study

Specific prerequisites

No special prerequisites apart from mandatory courses within the basic F-program.

Language of instruction

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

Intended learning outcomes

All fluid flows are governed by a single set of partial differential equations, the Navier-Stokes equations. This includes for instance, the aerodynamics of bumble bees and aerospace planes, the turbulence around vehicles and in the atmosphere and the convection in the sun and around a human body. The course is an in-depth introduction to fluid mechanics, with an emphasis of understanding fluid phenomena using on the Navier-Stokes equations. The equations are derived in detail and numerous examples of solutions are presented. Fluid Mechanics also has many important applications in engineering, geo- and astro-physics and bio-physics, for example, which makes this course ideal as a starting point for students with a varied interest in applications.

Course contents

The student should be able to

- derive the Navier-Stokes equations and explain the meaning of its terms, including the stress and deformation rate tensors
- describe the method of transferring from compressible to incompressible equations
- compute the flow field for a number of so called exact solutions
- derive the vorticity equation and give a physical explanation of its terms
- use the concepts of stream function and velocity potential, apply the Bernoulli equation and solve a number of simple potential problems
- discuss the principles of and derive the boundary layer approximation of the Navier-Stokes equations, and to give self similar solutions of these equations
- understand fundamental concepts in linear wave theory, such as group- and phase-velocity, and apply these to water waves
- describe the phenomena of separation of streamlines
- derive the Reynolds average equations and understand basic turbulence phenomena
- to be able to suggest methods of measuring the velocity in a fluid.

Course literature

Kundu & Cohen, Fluid Mechanics, Academic Press, 2004.

Examination

- INL1 - Assignment, 3.0 credits, grading scale: P, F
- TEN1 - Examination, 6.0 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

Homework assignment (INL1; 3 university credits)
Exam (TEN1;6 university credits).

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.