SG1215 Fluid Mechanics 4.0 credits

Strömningsmekanik

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

Establishment

Course syllabus for SG1215 valid from Autumn 2011

Grading scale

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

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

Since this course is a supplementary course to the basic courses in mechanics, SG1130 and SG1113, are these courses or corresponding courses a prerequisite.

In addition, he following courses of the main programme at F are recommended: SF1602, SF1603, SF1604, SK1102, DN1240, SF1629 och SI1140, or corresponding.

Language of instruction

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

Intended learning outcomes

- The student should be able to formulate mathematical models and make relevant approximations of fluid phenomena.
- The student should apply these models for simple cases and interpret the results.
- The student should gain some skill in carrying out experiments in fluids.

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
- 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 apply the Bernoulli equation
- Discuss the principles of and derive the boundary layer approximation of the Navier-Stokes equations, and to give self similar solutions of these equations including simple thermal boundary layers.
- Describe the phenomena of separation of streamlines.
- Suggest methods for measuring the velocity in a fluid.

Disposition

Nine two-hour lectures, five two-hour exercises and a lab exercise.

The lab exercise will be a central moment in the course. The aim of the exercise is to illustrate the existence of similarity solutions in boundary layers through wind tunnel measurements. The measurements will be carried out in a relatively early stage during the course, just after that the Navier-Stokes equations have been derived. The students will collect data which will be analyzed at a later stage when the theory for the laminar boundary layer has been presented. The lab report should contain the derivation of the similarity equation describing the general boundary layer, a numerical solution of the equation and a comparison between the experimental and theoretical results.

Course literature

Kundu & Cohen, Fluid Mechanics, Academic Press, 2008, lecture notes and lab manual.

Examination

- TEN1 - Examination, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Lab Exercise, 1.0 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.

- LAB1 – Lab exercise and lab report, 1.0 credits, grade scale: P, F
- TEN1 Examination, 3.0 credits

Other requirements for final grade

(TEN1; 3 credits), (LAB1; 1 credit). Examination testing skills in solving problems and applying mathematical methods. Completed lab exercise and lab report.

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.