FSG3113 Compressible Aerodynamics 9.0 credits

Kompressibel 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 FSG3113 valid from Spring 2010

Grading scale

undefined

Education cycle

Third cycle

Specific prerequisites

Basic courses at M, P, T or F and one of SG1217, SG1220, SG2223, SG2214 or equivalent courses.

Language of instruction

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

Intended learning outcomes

Finishing this course the student should know how to:

- derive the conservation laws of mass, momentum and energy of inviscid, compressible flow and apply them to various fluid dynamical problems to e.g.
  - analyse the interaction of forces between solid boundaries and flowing gases from the basic principles of compressible flow
  - analyse the energy conversion process in a flowing gas from the thermodynamic principles of isentropic and irreversible flow respectively
  - interpret results from performed experiments
- demonstrate a physical understanding of the mathematical formulas derived
- give a physical description of the special effects appearing in hypersonic flows.
- explain the consequences of the effects of compressibility on the flow in a viscous boundary layer

Course contents

For an inviscid, compressible gas the students should be able to

- calculate pressure, velocity and temperature for quasi one-dimensional, stationary, isentropic flow
- calculate changes of pressure, velocity and temperature over normal and oblique shock waves
- calculate changes of pressure, velocity and temperature in simple expansion waves
- calculate pressure, velocity and temperature for unsteady, one-dimensional, non-linear waves
- calculate the flow field in linear theory for subsonic and supersonic flow around bodies
- understand how pressure and drag on a body changes in transsonic flow
- derive the conservation equations governing the flow of compressible fluids in boundary layers
- derive solutions to the boundary layer equations for some cases demonstrating the main features of compressible flow in a boundary layer

Course literature

Andersson, Modern Compressible Flow, With Historical Perspective, Mc Graw Hill, 2003, ISBN 0-07-242443-5.

Selected paragraphs of: Transition, Turbulence and Combustion modelling, Lecture notes from the 2nd ERCOFTAC Summerschool held in Stockholm, 10-16 June, 1998. Edited by A. Hanifi, P.H. Alfredsson, A.V. Johansson and D.S. Henningsson.

Examination

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 assignments (INL1; 1,5 university credits), (INL2; 1,5 university credits).
Laboratory work (LAB1; 0,7 university credits), (LAB2; 0,8 university credits).
Final oral exam, (TEN1; 3 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.