LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Aerodynamik och kompressibel strömning
Aerodynamics and Compressible Flow

MMVN01, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED M
Date of Decision: 2023-04-11

General Information

Compulsory for: MHET1
Elective for: M4-en, M4-bem, M4-tt, W4-et
Language of instruction: The course will be given in English

Aim

The purposes of this course are to gain extended understanding and knowledge within the area of aerodynamics and compressible flow and to provide a general understanding of aerodynamic design of immersed bodies, in particular wings and other lifting surfaces.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to define shortly and/or clarify certain basic and more advanced concepts and phenomena within the area of aerodynamics and compressible flow; for example, center-of-pressure, circulation, velocity potential, the Kutta-Joukowski theorem, vortex sheets, mean chord line, the von Kármán log-law, boundary-layer separation, Mach wave, and normal shock wave
- have a comprehension of and be able to account for at some detail some basic and more advanced aerodynamic concepts; for example, the Lanchester-Prandtl lifting-line theory and the Prandtl-Meyer theory of oblique shock and expansion waves
- have a comprehension of the mechanisms of flow resistance and flow-induced forces considering technical aerodynamic design

Competences and skills

For a passing grade the student must

- be able to assess reliability and accuracy of input data and calculated results
- be able to carry out elementary analysis of laminar and turbulent boundary layers, fluid drag and lift on immersed bodies, and one- and two-dimensional compressible flow
- be able to carry out a detailed fluid analysis of subsonic and supersonic flow around lifting surfaces (wings) and compressible flow in nozzles and ducts

Judgement and approach
For a passing grade the student must

be able to communicate verbally and in writing with the teachers of the course as well as with the students peers, on matters considering basic phenomena and problems in fluid mechanics

be able to demonstrate written communication skills that are well-structured, learning-oriented and illustrative (group report and other written examination)

Contents

History and scope; basic principles, concepts and equations; potential flow; incompressible flow over airfoils and finite wings; laminar boundary layers; introduction to turbulence and turbulent boundary layers; bluff-body aerodynamics; normal and oblique shock waves, expansion fans; compressible flow in nozzles and ducts; subsonic and supersonic flow around airfoils.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Assessment of individual (written) home exercises, lab-reports, written and orally presented group exercise, and a written theory test (without means of assistance). The course mark is determined from a total sum, which consists of the result from the passed written test, the group exercise and bonus points (if any) from approved problem assignments. The graduation is determined from a special formula.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Admission

Admission requirements:

- MMVF01 Thermodynamics and Fluid Mechanics or MMVN10 Fluid Mechanics or VVRF10 Fluid Mechanics

Assumed prior knowledge: FMEA30 Engineering Mechanics.
The number of participants is limited to: No

Reading list

- Anderson, Jr., J. D: Fundamentals of Aerodynamics, Fifth Edition in SI Units. McGraw-Hill, 2011, ISBN: 978-007-128908-5.

Contact and other information

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