FSD3120 Flow Acoustics I 6.0 credits

Strömningsakustik I

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 FSD3120 valid from Autumn 2018

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

SD1120 Noise and Vibration or equivalent.

Language of instruction

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

Intended learning outcomes

Students graduating from the course should:

- Be able to derive the classical wave equation and be familiar with the solutions under plane and spherical symmetry including Greens functions.
- Be able to explain and apply a multipole-expansion and know the character of the simplest point sources (monopole, dipole, quadrupole).
- Know about Lighthills acoustic analogy and its limitations and be able to explain the physical mechanisms that generate sound in a flow.
- Know how flow and motion affects sound propagation and generation and be able to explain phenomena such as the Doppler-shift and the Mach-cone.
- Be able to apply Lighthills analogy to fluid machines and vehicles and know how the different mechanisms scale with the flow speed.
- Be able to explain how fluid driven self-sustained oscillators (”whistles”) are created and how they can be eliminated.
- Be able to apply 2-port theory to analyse sound propagation in pipe and duct systems in particular with application to vehicle exhaust systems.
- Have obtained training in experimental techniques for analysis of sound in ducts.

Course contents

Mathematical tools. The fundamental equations of fluid mechanics. The classical wave equation and its solutions. Multi-port theory. The inhomogeneous wave equation. Lighthills theory for aerodynamic sound. Curles equation. The convective wave equation. Sound propagation in ducts and pipes. Sound from moving sources. (”Ffowcs Williams&Hawkings equation”). Fluid driven self sustained oscillators – Whistles. Applications with focus on fluid machines and vehicles.

Course literature

Compendium - An introduction to flow acoustics, Mats Åbom

Examination

- PRO1 - Project work, 4.0 credits, grading scale: G
- TEN1 - Exam, 2.0 credits, grading scale: G

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.

Written examination + Home assignments + Project

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.