MJ2487 Aeromechanics Project Course 12.0 credits

Projektkurs i aeromekanik

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 MJ2487 valid from Spring 2019

Grading scale

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

Education cycle

Second cycle

Main field of study

Mechanical Engineering

Specific prerequisites

Language of instruction

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

Intended learning outcomes

The Intended Learning Outcomes (ILOs) for the course are that after completing the course the students will be able to:

- describe the phenomena of flutter and forced response

- plot and interpret a Campbell diagram

- analyze the current literature on turbomachinery aeromechanics

- explain the main assumption behind the standard methods used to analyze turbomachinery aeromechanics

- determine the fundamental structural modes of a turbine blade by using a state-of-the-art commercial software

- perform steady and unsteady flow simulations of a 3D turbine blade using a state-of-the-art commercial CFD software

- perform a flutter analysis of turbomachinery blade row

- present and describe the results of an aeromechanical analysis

Course contents

This is a course on the multi-disciplinary subject of turbomachinery aeromechanics. The subject combines the sub-topics of unsteady aerodynamics, structural dynamics and turbomachinery. The course will focus on the two main aeromechanical problems (flutter and forced response) that affect axial turbomachines. The students will learn the standard methods that are used to analyze aeromechanical problems and the assumption behind these standard methods. The students will also gain experience in reading literature on the field. The course will also give the students experience in performing a state-of-the-art aeromechanical analyses using commercial software that is currently used in industry. The students will also gain experience in presenting the results from aeromechanical analyses

The following topics will be covered in the course:

- Modelling of blade motion through modal analysis

- Application of FEM (Finite Element Method) on blade geometries

- Theory of unsteady aerodynamics for aeromechanics (forcing, damping, linear assumption)

- Coupling of structural-dynamic and fluid-dynamic equations

- Theory of flutter and Travelling Wave Modes (TWM)

- Theory of Forced Response and Campbell diagrams

- Industrial perspective of turbomachinery aeromechanics

- Analysis of the current literature

- Using ANSYS CFX software to solve a flutter problem (this include mesh generation, setup and running of steady-state simulations, setting up unsteady flow simulation with moving mesh, running unsteady flow simulation, post processing results for unsteady flow simulation)

- Flutter analysis and reporting

Disposition

PROJ Projekt 9,0 credits. Grades A, B, C, D, E, FX, F

TEN1 Tentamen 3,0 credits. Grades A, B, C, D, E, FX, F

Course literature

The literature for the course will be selected articles and lecture notes which will be made available on Canvas.

Examination

- PROJ - Project, 9.0 credits, grading scale: A, B, C, D, E, FX, F
- TEN1 - Written exam, 3.0 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

To receive a final, the student must pass both components TEN1 and PROJ. The final grade is dependent on the performance in both components.

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.