Vibration Analysis of Structures

Programme course

6 credits

Strukturdynamik

TMME40

Valid from: 2020 Spring semester

Determined by
Board of Studies for Mechanical Engineering and Design

Date determined
2019-09-23

Main field of study

Mechanical Engineering

Course level

Second cycle

Advancement level

A1X

Course offered for

- Master's Programme in Aeronautical Engineering
- Master's Programme in Mechanical Engineering
- Mechanical Engineering, M Sc in Engineering

Entry requirements

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites

Mechanics, as well as basic courses in mathematics, mechanics of materials and structural engineering.

Intended learning outcomes

The objective of the course is to familiarize the student with fundamental laws in mechanics of vibration, and to give the student the proficiency needed to independently apply these laws to vibration problems. After completed the course, the student is able to:

- model simple and more complex mechanical systems;
- understand definitions and fundamental concepts used in mechanics of vibrations, e.g. velocity, acceleration, energy, frequency, period and damping factor;
- use modal analysis, solve eigenvalue problems and determine frequencies and

eigenmodes for different structural elements;
- use Lagrange's equations to derive the governing equations for a vibrating system;
- solve the governing equations analytically and numerically;
- perform simpler analyses for stability of non-linear systems;
- derive simpler theorems used within mechanics of vibration.

Course content

Modelling of vibrating systems. Derivation of the governing equations using Newton's laws and Lagrange's equations for linear systems. Systems with one or multiple degrees of freedom. Analytical solution of free and damped oscillations including harmonic and general forcing. Methods for determining eigenfrequencies. Modal analysis. Discrete and continuous systems. Approximation methods and finite elements.

Teaching and working methods

The teaching comprises lectures, tutorials and computer laborations.

Examination

UPG2	Hand-in exercises	U, 3, 4, 5	6 credits

Grades

Four-grade scale, LiU, U, 3, 4, 5

Other information

About teaching and examination language

The teaching language is presented in the Overview tab for each course. The examination language relates to the teaching language as follows:

- If teaching language is Swedish, the course as a whole or in large parts, is taught in Swedish. Please note that although teaching language is Swedish, parts of the course could be given in English. Examination language is Swedish.
- If teaching language is Swedish/English, the course as a whole will be taught in English if students without prior knowledge of the Swedish language participate. Examination language is Swedish or English (depending on teaching language).
- If teaching language is English, the course as a whole is taught in English.

Examination language is English.

Other

The course is conducted in a manner where both men's and women's experience and knowledge are made visible and developed.

The planning and implementation of a course should correspond to the course syllabus. The course evaluation should therefore be conducted with the course syllabus as a starting point.

Department

Institutionen för ekonomisk och industriell utveckling

Director of Studies or equivalent

Peter Schmidt

Examiner

Jonas Stålhand

Course website and other links

Education components

Preliminary scheduled hours: 50 h
Recommended self-study hours: 110 h

Course literature

Books

Inman, J.D., *Engineering Vibrations* 4