Vibration Analysis of Structures

Programme course

6 credits

Strukturdynamik

TMME40

Valid from: 2019 Spring semester

Determined by
Board of Studies for Mechanical Engineering and Design

Date determined
2018-08-31

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	6 credits	U, 3, 4, 5

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

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