

# Vibration Analysis of Structures

Programme course

6 credits

Strukturdynamik

TMME40

Valid from: 2018 Spring semester

**Determined by**

Board of Studies for Mechanical Engineering  
and Design

**Date determined**

## Main field of study

Mechanical Engineering

## Course level

Second cycle

## Advancement level

A1X

## Course offered for

- Aeronautical Engineering, Master's Programme
- Mechanical Engineering, M Sc in Engineering
- Industrial Engineering and Management - International, M Sc in Engineering
- Industrial Engineering and Management, M Sc in Engineering
- Mechanical Engineering, Master's Programme

## 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

## 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*