Course syllabus

Strukturdynamiska beräkningar
Structural Dynamic Computing

VSMN10, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED V
Date of Decision: 2023-03-21

General Information

Elective for: F4, F4-bem, M4, Pi4-bem, V4-ko
Language of instruction: The course will be given in English on demand

Aim

The course aims to provide knowledge of theory, computation and measurement methods in the field of structural dynamics. It will also develop the ability to evaluate models using computational programs in relation to laboratory results in project work. The course also aims to develop skills in written and oral presentations.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- Be able to solve and analyze conceptual construction assignments based on real structural problems.
- Be able to measure, calculate and reflect upon physical properties on these structures.
- Be able to compare, relate and verify obtained computational results against experimentally measured values.
- Be able to identify, apply and reflect upon the physical concepts and their mathematical syntax.

Competences and skills
For a passing grade the student must

- Be able to analyse general single-dof-problems.

- Be able to define, calculate and analyse structural dynamics multi-dof-problems, based on a finite element formulation.
- Be able to apply, assess and reflect upon different solution strategies for structural dynamics problems.
- Be able to apply advanced computational methods in structural dynamics to solve problems where there are several alternative solution possibilities, and be able to relate, assess and reflect upon differencies in method and result.
- Explain, argue for and reflect upon the chosen solution method at a final seminar.
- Be able to use advanced computational codes.

Judgement and approach
For a passing grade the student must

- Be able to compare and assess different solutions and their accuracy.
- Be able to compare, relate and critically scrutinize both own and others proposed solutions at a seminar discussion.
- Be able to hypothesize and discuss solutions based on incomplete data, recognize their scope and propose changes in basic conditions.
- Be able to summarize results in a technial report, and compare and assess colleagues' reports in relation to one's own.

Contents

Single-dof models. Generalized Single-dof models. Time integration; Newmark’s method, implicit method, explicit method. Multi-dof models; finite elements, direct integration, modal superposition, eigenvalue analysis, response diagram. Earthquake analysis.

The lectures describe the theoretical concepts in relation to the application, with conceptual construction assignments which show how the realistic questions enhance the mathematical and numerical descriptions. The construction assignments relate to applied mechanics with the finite element method as basis for the work.

Beyond this, activities dealing with general computer code systems for finite element analysis, e.g. Abaqus are planned. The computational tool Calfem is also used. This kind of computer code systems can be used in a wide range of physical/engineering problems. Construction assignment 2 is designed so that it is natural to use one of these systems.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: The assessment is based on hand-in assignments, two computational reports, theory test, and oral discussions at seminars.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Admission

Admission requirements:

- VSMN30 The Finite Element Method - Structural Analysis: part Design Assignments 2.5 hp OR FHLF01 Finite Element Method OR FHLF10 Finite Element Method and Introduction to Strength of Materials OR FHLF20 Finite Element Method

The number of participants is limited to: No
The course overlaps following course/s: VSM045, VSM051

Reading list

- Anil K. Chopra: Dynamics of Structures, Theory and Applications to Earthquake Engineering. Pearson, 2020.
- Austrell et al.: CALFEM, A finite element toolbox. Freely available online.

Contact and other information

Course coordinator: Peter Persson, peter.persson@construction.lth.se
Course homepage: http://Canvas