SE2134 Dynamic Problems in Solid Mechanics 7.5 credits

Dynamik inom hållfasthetsläran

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for SE2134 valid from Spring 2014

Grading scale

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

Education cycle

Second cycle

Main field of study

Technology

Specific prerequisites

SE1010 or 4C1020 or SE1055; SE1025. Differential equations and transform methods I or Differential equations and transform methods II.

Language of instruction

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

Intended learning outcomes

A large number of structural failures in machinery and even in electronic assemblies happen due to undesirable vibrations or other transient (time-dependent) effects. These effects can be caused by external factors (such as impact, for example) or by the internal components of the product at some operational modes. Therefore, a dynamic analysis is an essential part of the product development process in number of industries. Conducting such an analysis, interpreting the results and making necessary design improvements requires certain skills, which are exceptionally rare among engineers. This course will help you to gain some of these skills and to build an analytical foundation for advancing further in this field.

After the course, the participants should be able to

- formulate the problems and present the solutions using terms, concepts and vocabulary of the course;
- construct a model for representing a structure with single and multiple degrees of freedom;
- solve dynamic model problems using analytical methods;
- analyse and interpret the results of dynamic analyses;
- carry out comprehensive dynamic analyses of thin beams and plates, which constitute a very broad class of engineering structures;
- use numerical finite element analysis to determine natural frequencies and modes of an arbitrary 3D structure;
- perform harmonic analyses of an arbitrary 3D structure with finite element method;
- perform spectrum and random vibration analyses of an arbitrary 3D structure with finite element method;
- modify structural design to avoid undesirable vibrations.

Course contents

The course will cover the methods and tools used for dynamic analyses of structures. The learned material will be exercised on simple but yet realistic structures.

Course literature

Olsson, M., Kulachenko, A., Dynamics of solid – a primer, KTH, 2012.
Formelsamling i Hållfasthetslära, Hållfasthetslära, KTH, 2013.

Frivilliga läsförslag:
Timoshenko, S., Young, D., Weaver, W., “Vibration Problems in Engineering”, Wiley-Interscience; 5+ edition, 1990+.
Thorby, D., Structural dynamics and vibration in practice: an engineering handbook, Butterworth-Heinemann, 2008.

Examination

- HEM1 - Assignment, 3.0 credits, grading scale: P, F
- TEN1 - Examination, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Work, 1.5 credits, grading scale: P, 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.

If the course is discontinued, students may request to be examined during the following two academic years.

The exam will involve solving one problem by taken a reasonable abstraction, constructing a model and applying one of the learned methods to solve it. The exam will also include a theoretical question required for the highest grade. If required the student may be offered the opportunity to oraly complete an incomplete answer to the theory question.

The course will include several seminars where the real engineering problems will be openly discussed the students. Home assignments examination also include the mandatory participation in the seminar presentation.

Other requirements for final grade

Assignments (HEM1; 3 credits)
Laboratory work (LAB1; 1,5 credits)
Examination (TEN1; 3,0 credits)

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.