SD2180 Non-linear Acoustics 6.0 credits

Ickelinjär akustik

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

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

Establishment

Course syllabus for SD2180 valid from Autumn 2007

Grading scale

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

Education cycle

Second cycle

Main field of study

Specific prerequisites

Basic courses in mathematics, mechanics and noise control.

Language of instruction

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

Intended learning outcomes

After the course, the participant shall be able to:

- Apply perturbation methods to new situations:
  - Predict the response of a novel, non-linear system – approximated by a conservative, finite degree-of-system – using a perturbation method.
  - Predict the response of a novel, non-linear system – approximated by a non-conservative, finite degree-of-system – using a perturbation method.
  - Calculate all the resonance frequencies of a forced, novel, non-linear system – approximated by a non-conservative, single degree-of-system – using a perturbation method.
  - Demonstrate a correct use of a perturbation method in the prediction of the standing wave response of a novel, non-linear continuous system – such as string, beam, plate or shell.
  - Predict the travelling wave response of a novel, non-linear continuous system using a perturbation method.
- Analyze non-linear acoustic phenomena:
  - Identify the non-linear phenomena for finite degree-of-freedom systems.
  - Point out the reasons for the non-linear phenomena for finite degree-of-freedom systems.
  - Identify the non-linear phenomena for continuous systems.
  - Point out the reasons for the non-linear phenomena for continuous systems.
- Judge the value of applied perturbation methods for a given application:
  - Write a short exposition evaluating the relative merits of the applied perturbation methods.
  - Compare the response results predicted by a perturbation method with those of a basic numerical method.
  - Explain the reasons for a good match between results obtained by a perturbation method and those of a basic numerical method.
  - Explain the reasons for any mismatch between results obtained by a perturbation method and those of a basic numerical method.

Also after the course, for higher grades (A-C), the participant shall be able to:

- Display a scientific attitude towards non-linear problems:
  - Demonstrate curiosity in identifying non-linear problems.
  - Seek natural causes of non-linear phenomena.
  - Demonstrate open-mindedness when seeking solutions.
  - Suspend judgments until all evidence is available.
  - Show objectivity in analyzing evidence and drawing conclusions.
  - Show willingness to revise conclusions as new evidence becomes available.

Course contents

Conservative and non-conservative systems, forced oscillations of systems, continuous systems and travelling waves. Perturbation methods – such as straightforward expansion, Lindstedt-Poincaré method, method of multiple scales, method of harmonic balance, method of averaging – and basic numerical methods.

Course literature

Compendium Non-linear Acoustics, Leif Kari

Examination

- TEN1 - Examination, 6.0 credits, grading scale: A, B, C, D, E, FX, 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.

Other requirements for final grade

Written home assignments (TEN1; 6 university 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.