FEL3500 Introduction to Model Order Reduction 7.0 credits

Introduktion till modellreduktion

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 FEL3500 valid from Autumn 2008

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

This is a graduate level course, but last-year/advanced undergraduate students may also be admitted.

Language of instruction

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

Intended learning outcomes

After finishing the course, the student will

- be able to distinguish between hard and simple model reduction problems
- be able to apply standard model reduction techniques such as POD/PCA/SVD to examples that are relevant to the student
- understand the interplay between controllability, observability and model reduction
- know the theory behind balanced truncation and Hankel norm approximation
- be able to reduce the order of linear feedback and feedforward controllers while taking the overall system performance into account.

Course contents

There are nine lectures in the course:

Lecture 1: Introduction. The model-order-reduction problem. Examples.

Lecture 2: Model truncation, singular perturbation.

Lecture 3: Linear systems: POD/PCA/SVD-based simplification

Lecture 4: Linear systems: Gramians and balanced realizations

Lecture 5: Linear systems: Balanced truncation and weighted extensions.

Lecture 6: Applications: Controller and nonlinear model reduction.

Lecture 7: Optimal model reduction: Hankel norm approximation.

Lecture 8: System identification and model reduction in H2-norm (guestlecture).

Lecture 9: Summary

Disposition

There are nine lectures and seven exercise sessions in the course. Every set of lecture notes comes with 2-4 hand-in problems. These are to be solved and turned in seven days after they have been handed out.The problems are then solved and discussed in the following exercise session. The student should also do a project where model reduction is performed on a model that preferably relates as much as possible to the student's own research project.

Examination

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

To pass, the student needs to complete:

1. at least 75% of the turn-in problems.

2. a smaller project with an approved report.

3. a take-home exam.

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.