



# FEL3500 Introduktion till modellreduktion 7,0 hp

Introduction to Model Order Reduction

När kurs inte längre ges har student möjlighet att examineras under ytterligare två läsår.

## Fastställande

Kursplan för FEL3500 gäller från och med HT08

## Betygsskala

P, F

## Utbildningsnivå

Forskarnivå

## Särskild behörighet

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

## Undervisningsspråk

Undervisningsspråk anges i kurstillfällesinformationen i kurs- och programkatalogen.

## Lärandemål

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.

## Kursinnehåll

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: 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  $H_2$ -norm (guestlecture).

Lecture 9: Summary

## Kursupplägg

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 preferably related as much as possible to the student's own research project.

## Examination

Examinator beslutar, baserat på rekommendation från KTH:s handläggare av stöd till studenter med funktionsnedsättning, om eventuell anpassad examination för studenter med dokumenterad, varaktig funktionsnedsättning.

Examinator får medge annan examinationsform vid omexamination av enstaka studenter.

## Övriga krav för slutbetyg

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.

## **Etiskt förhållningssätt**

- Vid grupparbete har alla i gruppen ansvar för gruppens arbete.
- Vid examination ska varje student ärligt redovisa hjälp som erhållits och källor som använts.
- Vid muntlig examination ska varje student kunna redogöra för hela uppgiften och hela lösningen.