EQ2800 Optimal Filtering 6.0 credits

Optimal filtrering

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

Establishment

Course syllabus for EQ2800 valid from Autumn 2007

Grading scale

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

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

180hp and English B or equivalent

Language of instruction

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

Intended learning outcomes

After successfully completing the course, the student should be able to

- Understand to which type of estimation problems linear estimation can be applied.
- Understand the relationship between computational complexity, filter structure, and performance.
- Understand the relationship between optimal filtering, linear estimation, and Wiener/Kalman filtering.
- Approach estimation problems in a systematic way.
- Compute, analyze, and modify state space models.
- Derive and manipulate the Wiener and Kalman filter (time discrete and time continuous) equations.
- Compute the Wiener and Kalman filters (time discrete and time continuous) for a given estimation problem.
- Analyze properties of the optimal filter.
- Implement Wiener and Kalman filters (time discrete) and state space models using Matlab.
- Simulate state space models and optimal filters, analyze the results, optimize the filter performance, and provide a written report on the findings.
- Explain important implementational aspects in linear estimation and derive square-root algorithms.

Course contents

This course gives thorough knowledge of optimal linear estimation theory. Kalman and Weiner filtering are systematic methods to solve many estimation problems in modern technical applications and the student will be able to apply these methods to estimation problems. The course assumes familiarity with basic concepts from matrix theory, linear algebra, and linear system theory. We will treat optimal linear estimation, which is encountered in many areas of engineering such as communications, control, and signal processing, and also in several other fields, e.g., econometrics and statistics. The course is directed towards the students who intend to work with development and research within these fields.

This is a graduate level course that can be taken by undergraduate students who are admitted. Only students with adequate prerequisities will be admitted. It requires a large amount of self study. There are two versions of the course, a 4 credit course requiring only homework problems and a project assignment. The 8 credit version also requires an examination and the presentation of a special topic.

The following topics are covered; Basic estimation theory, least squares problems, the innovations process, state-space models, time discrete and time continuous Wiener filters, time discrete and time continuous Kalman filters, properties of optimal filters, smoothing, implementation aspects.

Course literature

Linear Estimation, Kailath, Sayed, Hassibi

Examination

- TEN1 - Examination, 4.5 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Work, 1.5 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.

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

Other requirements for final grade

Homeworks every week
Oral examination (not required if homeworks are correct)
Project assignment

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.