FEM3210 HT23 Estimation Theory

Welcome to FEM3210 Estimation theory, 10cr !

This is an introductory course to statistical estimation theory given from a signal processing perspective. The aim is to provide the basic principles and tools that are useful to solve many estimation problems in signal processing, communications, and related areas. It will also serve as the necessary prerequisite for more advanced texts and research papers in the area. The course will cover fundamental concepts such as sufficient statistics, the Rao-Blackwell theorem and the Cramer-Rao lower bound on estimation accuracy. Furthermore, the most common estimation methods are treated, including maximum likelihood, least-squares, minimum variance, method of moments and Bayesian estimation. The course assumes some familiarity with basic matrix theory and statistics

Contact:

Course responsible and lecturer: [Magnus Jansson](), [janssonm@kth.se]()

General Information

- The first part of the course coincides with the MSc level course EQ2810 Estimation theory, accelerated program course, 6 cr.
- Course responsible and examiner: Magnus Jansson
- Where: See the schedule in Time Edit for the master version EQ2810 to find out.
- When: Period 1-2 every odd year. See the schedule for the master version EQ2810 for details.
- Course literature: "Fundamentals of Statistical Signal Processing: Estimation Theory," Kay, Steven M. ISBN 0133457117.
- Grading: Pass/Fail

Course requirements

- Weekly homework assignments, to be solved and reported individually
- Peer grading of homework assignments
- Two project assignments
- 48 hour take-home examination

Course contents can be learnt by cooperative discussions, but homework problems should be solved
individually and handed in in due time for grading. Please recall the KTH rules for examination.

For passing the course we require 80% of the total score on homework and project assignments and 50% on exam as well as a serious completion of the peer grading task.

Preliminary Schedule

See KTH central schedule for EQ2810 for the official times and lecture rooms:

https://cloud.timeedit.net/kth/web/staff01/ri63n65Yg7657ZQ0g5QY7657Z769X395Q6QY550yZ05Q5066tZ53d938E00302CB9312t9E9BA69Q80D087798A7CZE840.ics

We have six time-slots scheduled for normal lectures:
Lec. 1: Ch. 1-3
Lec. 2: Ch. 4-5
Lec. 3: Ch. 6-7
Lec. 4: Ch. 8-9
Lec. 5: Ch. 10-11
Lec. 6: Ch. 12,14,15

Lec. 7: Project 2 : student presentations

Outline of the book

Ch. 1: Introduction
Ch. 2: Minimum Variance Unbiased Estimation
Ch. 3: Cramer Rao Lower Bound
Ch. 4: Linear Models
Ch. 5: General Minimum Variance Unbiased Estimation
Ch. 6: Best Linear Unbiased Estimators
Ch. 7: Maximum Likelihood Estimation
Ch. 8: Least Squares
Ch. 9: Method of Moments
Ch. 10: The Bayesian Philosophy
Ch. 11: General Bayesian Estimators
Ch. 12: Linear Bayesian Estimators
Ch. 14: Summary of Estimators
Ch. 15: Extensions for Complex Data and Parameters

 (Ch. 13: Kalman filtering - will not be covered in this course, see Adaptive signal processing or Optimal filtering courses)

Intended learning outcomes

The intended learning outcomes and other general course information can be found in the course directory:

https://www.kth.se/student/kurser/kurs/FEM3210