EQ2300 Digital Signal Processing 7.5 credits

Digital signalbehandling

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

Establishment

Course syllabus for EQ2300 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

For single course students: 120 credits and documented proficiency in 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

Goals of the course: After the course, each student is expected to be able to:

- Use a combination of theory and software implementations to solve signal processing problems.
- Estimate the spectral density of a signal, based on a limited number of noise samples. Especially:
- Implement and use non-parametric methods for
- spectral estimation, such as
- the Periodogram
- Bartlett's method
- Welch's method
- the Blackman-Tukey method,

and to be able to analyze the accuracy and determine advantages and disadvantages of each method.

- Implement and use parametric methods for spectral estimation, such as
- AR modeling
- The Pisarenko method.
- Implement and use methods to increase or decrease the data rate of a sampled signal and determine how the signal is affected in the time and frequency domains.
- Implement and use filter banks to split a signal into subbands and reconstruct the original signal.
- Work with model based signal processing. Especially,
- to formulate linear and non-linear models for signals and systems.
- Estimate parameters in the models, using MMSE and least squares methods.
- Use the models with the estimated parameters in applications such as spectral estimation and prediction.
- Design efficient implementations of digital systems. Especially,
- Use the FFT algorithm for efficient computation of
- Linear filtering of long streams of data.
- Non-parametric spectral estimation.
- Implement and use the Levinson Durbin algorithm and lattice filters, for example to
- Quickly estimate model parameters.
- Determine the stability of linear systems.
- Be able to determine, quantitatively and qualitatively, what happens to an algorithm when it is implemented using fixed point arithmetics.

Course contents

Non-parametric and parametric spectral estimation. Multirate systems, decimation and interpolation. Effects of quantization and finite word length. Model based signal processing, prediction and estimation, fast algorithms and lattice structures. Non-linear least squares methods and an introduction to subspace methods. Matrix algebra.

Course literature

- Monson H. Hayes, Statistical Digital Signal Processing and Modeling, Wiley, 1996. Alternative text book: John G. Proakis & Dimitris G. Manolakis: Digital Signal Processing, third edition 1996 (ISBN 0-13-394289-9 or 0-13-373762-4) eor fourth edition 2006.)
- Additional course material from the department.

Examination

- LAB2 - Laboratory Work, 1.0 credits, grading scale: P, F
- TEN1 - Examination, 6.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Work, 0.5 credits, grading scale: P, 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

One hand-on laboratory exercise (LAB1) with oral presentation of preparatory exercises and the results. Two take home project assignments (LAB2) solved and reported in groups of at most two students.
One written examination

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.