II1303 Signal Processing 7.5 credits

Signalbehandling

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 II1303 valid from Spring 2019

Grading scale

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

Education cycle

First cycle

Main field of study

Technology

Language of instruction

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

Intended learning outcomes

Course Objectives

As part of this course, students will:

- understand mathematical representation of discrete-time and continuous-time signals
- will be introduced to signal processing and characterization techniques, such as filtering, frequency response, and transforms
- gain laboratory experience in computer-based signal processing.

Course Outcomes

Upon successful completion of this course, students should be able to:

- express signal processing systems in mathematical form
- write MatLab code describing a signal processing system
- analyze signals in terms of their frequency content.
- describe system behavior in terms of frequency content
- describe system behavior in terms of frequency response
- describe system behavior in terms of the Fourier Transform
- analyze mixed analog-digital systems with sampling operations and digital filters
- utilize the z
- transform to analyze discrete-time systems in terms of poles and zeroes
- use complex exponential notation to describe signals and systems
- describe how signal processing is used in applications (e.g., audio and digital image processing).

Course contents

- Sinusoidal Signals
- Amplitude, Phase & Frequency
- Complex Exponential Representation (Phasors)
- Spectrum Representation of Signals
- Sinusoids, Harmonics Other Synthesis Examples: e.g., Chirp (FM) Signals
- Fourier Series: Synthesis & Analysis
- Digital Signals and Sampling
- Aliasing & Folding
- Reconstruction from Samples
- Moving Average Filters
- Finite-Length Impulse Response (FIR)
- Convolution
- Linearity & Time-Invariance
- Frequency Response
- Magnitude & Phase Responses

- Lowpass, Highpass & Bandpass Filters
- Z-Transform
- Method for FIR
- Zeros of the Transfer Function Polynomial
- Cascading Systems
- Relationship to Frequency ResponseRecursive Filters
- Feedback Difference Equations
- Discretizing Differential Equations
- Impulse Response
- Z-transform for Recursive Filters
- Second-Order (Narrowband) FiltersSpectrum Analysis
- Fourier Transform (Continuous-Time)
- Discrete-Time Fourier Transform
- FFT Algorithm
- Relationship between Continuous-Time and Discrete-Time Frequency Domains
- Short-Time Fourier Analysis & Spectrograms
- Bandpass Filter Banks

Specific prerequisites

Completed upper secondary education including documented proficiency in Swedish corresponding to Swedish B and English corresponding to English A. For students who received/will receive their final school grades after 31 December 2009, there is an additional entry requirement for mathematics as follows: documented proficiency in mathematics corresponding to Mathematics A. Specific requirements corresponding to Physics B and Chemistry A and mathematics corresponding to courses IX1303 and IX1304.

Course literature

Signal Processing First, McClellan, Schafer, YoderUpplaga: Förlag: Pearson Prentice Hall År: ISBN: 0-13-120265-0

Examination

- LAB1 - Laboratory Work, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- TEN1 - Examination, 4.5 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.

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.