# Digital Filters

Programme course

6 credits

Digitala filter

TSTE06

Valid from: 2017 Spring semester

**Determined by**
Board of Studies for Electrical Engineering, Physics and Mathematics

**Date determined**
2017-01-25

# Main field of study
Electrical Engineering

# Course level
Second cycle

# Advancement level
A1X

# Course offered for
- Computer Science and Engineering, M Sc in Engineering
- Industrial Engineering and Management - International, M Sc in Engineering
- Electronics Design Engineering, M Sc in Engineering
- Industrial Engineering and Management, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Electronics Engineering, Master's programme
- Information Technology, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering

# Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

# Prerequisites
Basic courses in circuit theory and linear systems.

# Intended learning outcomes
The aim of the course is to give the theoretical basis for analysis and synthesis of digital filters and basic knowledge about implementation of digital filters in hardware and software. After the course, the student is expected to be able to:

- synthesize FIR and IIR filters, especially wave digital filters,
- analyze finite wordlength effects in digital filters,
- synthesize digital systems with several sampling frequencies using interpolation and decimation,
- analyze computational properties of recursive algorithms,
- use computer programs to solve problems within digital filtering.

## Course content

Discrete-time and digital signals and systems. Approximation theory, Butterworth, Chebyshev-I, Chebyshev-II and Cauer-filters. Frequency transformations. Synthesis of IIR and FIR filters, especially wave digital filters. System with several sampling frequencies, decimation and interpolation. Finite word lengths effects. Computational properties of recursive DSP algorithms. Implementation of digital filters.

## Teaching and working methods

Lectures, lessons, and laboratory exercises

## Examination

| | | | |
|---|---|---|---|
| LAB1 | Laboratory work | 1.5 credits | U, G |
| TEN1 | Written examination | 4.5 credits | U, 3, 4, 5 |

## Grades

Four-grade scale, LiU, U, 3, 4, 5

## Department

Institutionen för systemteknik

## Director of Studies or equivalent

Klas Nordberg

## Examiner

Håkan Johansson

## Course website and other links

## Education components

Preliminary scheduled hours: 56 h
Recommended self-study hours: 104 h

## Course literature

L. Wanhammar and H. Johansson: Digital Filters Using Matlab, 2013 L. Wanhammar: Tables and Formulas for Analog and Digital Filters

# Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.