

Digital Filters, TSTE06/TSEI07, 2017

<http://www.commsys.isy.liu.se/en/student/kurser/TSTE06> (TSEI07)

Teachers

Lectures, lessons, labs, and examination: Håkan Johansson (hakan.johansson@liu.se)

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Course material

Lars Wanhammar and Håkan Johansson: *Digital Filters Using Matlab*

Lars Wanhammar: Tables and formulas for analog and digital filters

Problems and solutions for the lessons

Lab material

The course book and Tables&Formulas can be purchased in the A building (close to LiU-Tryck)

The lab material and solutions can be downloaded from the course homepage. Most of the problems are included in the course book. Some additional problems (named A.1 etc.) can be downloaded.

Aim of the Course

To provide:

- The theoretical basis for analysis and synthesis of digital filters
- Basic knowledge about implementation of digital filters

After the course, you are expected to be able to:

- Synthesize FIR and IIR filters, especially wave digital filters
- Use computer programs (Matlab) to design digital filters
- Analyze finite wordlength effects in digital filters
- Analyze computational properties of recursive algorithms
- Synthesize interpolation and decimation filters (multirate filters)

Lectures, 20 h (10 occasions). Schedule on the next page.

Lessons, 20 h (10 occasions). Schedule on the next page.

Laboratory exercises, 16 h (four occasions)

Basic Matlab functions, examples in the supplementary material
(Alternatively Digital Filter Toolbox, examples in the course book)

The labs are **mandatory** in order **to pass the whole course**.

Examination

A written exam (4 hours), 70 points, 30 points required to pass. Exam aids: Tables and formulas for analog and digital filters, mathematical tables, and pocket calculator. *Do not write in them!*

Optional seminars (oral), two occasions

Give max 10 p (5 + 5) on the written exam, corresponding to Problem 1

Registration - Please register for the course!

Lecture schedule, 20 h

Lecture 1: Digital filters

Lecture 2: DSP algorithms

Lecture 3: Finite wordlength effects

Lecture 4: FIR filters

Lecture 5: Synthesis of analog filters (needed for IIR filters)

Lecture 6: Synthesis of IIR filters

Lecture 7: Multirate systems

Lecture 8: Wave digital filters

Lecture 9: Wave digital filters (cont'd).

Lecture 10: Wave digital filters (cont'd).

Lesson schedule, 20 h

Table 1: Recommended Problems

Lesson	TSTE06 and TSEI07	TSTE06
1	1.9, 2.2, 2.3, 2.14, 2.15, 2.16	2.12, 2.13
2	3.1, 3.2, 3.3, 3.4, 3.6, 3.7, 3.8	A.1
3	4.1, 4.6, 4.11, 4.18, 4.21	4.25, 4.16, 4.17
4	5.4, 5.5, 5.7, 5.9, 5.11	5.12
5	7.5, 7.8, 7.12, 7.14	7.2, 7.18
6	8.6, 8.11, 8.16	8.21, 8.24
7	13.16, 13.18, 13.20, 13.21, 13.23	13.1, 13.19
8	12.1, A.2, A.3, 13.2	12.2, 12.3, A.4, A.5
9	11.2, 11.9, 11.10	A.6, A.7
10	11.19, 11.11, 11.13	11.22, 10.9, A.8