Digital Signal Processing (6 ECTS)

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Signal Processing begins with a discussion of the analysis and representation of analog and discrete-time signal systems, including: convolution, differential/difference equations, the z-transform, and the Fourier transform. Emphasis is placed on the similarities and distinctions between discrete-time. The course proceeds to cover analog/digital network and non-recursive (finite impulse response) digital filters. Digital Signal Processing concludes with digital filter design and a discussion of the fast Fourier transform algorithm for computation of the discrete Fourier transform.

The course covers the following topics:

1. Introduction to signal processing. Properties of LTI continuous filters
2. The Fourier series and transform
3. The frequency response of a linear system defined directly from the Fourier transform
4. Low-pass, high and bandpas filter design. Second-order filter sections
5. Introduction to discrete-time signal processing
6. The sampling theorem
7. The discrete Fourier transform (DFT). The fast Fourier transform (FFT)
8. Introduction to time-domain digital signal processing
9. The z-transform. The Inverse z-Transform
10. The discrete-time transfer function. Introduction to z-plane stability criteria
11. Frequency response and poles and zeros
12. FIR low-pass filter design. FIR low-pass filter design by windowing
13. The design of IIR filters
14. Interpolation and decimation
15. Introduction to random signals

Aims of the course:

After completing the course, students will understand the concepts of analog/digital signal processing. Students will be able to apply the technology used during the lessons in solving problems connected to analog/digital signal processing, such as signal filtering and noise elimination/reduction.