Title: Signals and Systems

Lecturer: Prof. Dr. Franc Smole

Aim of the Course:
To recognize various signal forms and methods for their description and processing. To acquire basic knowledge about systems theory, which enables systematic analysis and design of the systems. To learn about the use of modern computer tools for systems analysis and simulation. To present the implementation of basic systems theory into systematic solutions for analysis and design of electric circuits and filters.

Required (pre)knowledge:
Basic knowledge of electrical engineering and mathematics

Contents:
Classification of signals and systems. System modeling concepts, input-output description, linearity, time-invariance, causality. Unit impulse and unit step response. Superposition and convolution integrals. Fourier and Laplace representation of signals. Laplace transforms and system functions. Frequency responses, responses of systems to periodic signals. Bode plots, polar plots. Interconnections of systems. Linear feedback systems. The Nyquist stability criterion. Gain and phase margins. State-variable concepts. Form of the state equations. Time-domain and frequency-domain solution of the state equations. Finding the state transition matrix. State equations for electric circuit. Circuit topology and general circuit analysis. Continuous-time filters. Distortionless transmission. Ideal filters. Approximation of ideal filters. Frequency transformations. Properties and synthesis of passive networks. Basics of active filters. Biquad circuits. High-order active filters. Active simulation of passive filters. Switched-capacitor filters.

Selected references:
R. D. Sturm, D. E. Kirk, Contemporary Linear Systems Using MATLAB, BookWare companion series, 1999.
Douglas K. Lindner, Introduction to Signals and Systems, WCB/McGraw-Hill, 2003.
C. L. Phillips, J. M. Parr, Signals, Systems, and Transforms, Prentice Hall, 2007.
K. L. Su, Analog Filters, Kluwer Academic Publishers Group, 2010.
Rolf Schaumann, Mac E. Van Valkenburg, Design of analog filters, Oxford University Press, 2003.