

Title: Continuous signals and systems

Lecturer: Prof. Dr. Andrej Košir

Aim of the course:

To provide knowledge about continuous electrical circuits and different techniques for analyzing electrical circuits. To provide basic knowledge of LTI systems and knowledge about analyzing linear system (including a selection of linear system phenomenon).

Required (pre)knowledge:

Analysis and calculus

Contents:

Definition, properties and limitations of a linear circuit. Characteristics of ideal circuit components (resistor, inductor, capacitor..). Topological circuit description and associated methods (incidence matrix, reduced incidence matrix). Different circuit analysis methods, such as mesh analysis method and node analysis method. Duality and Tellegen's theorem.

Introduction of polar coordinates, phasors and frequency. Calculating with phasors and converting back to time-based values. Basic circuit element characteristics with regards to frequency. Determining transmission functions.

Single-input circuits: Thevenin and Norton Equivalent Circuits. Maximum power transmission theorem, resonance.

Dual-input circuits: reciprocity theorem, Modeling circuit as a quadripole and determining different quadripole parameters (impedance-based, admittance-based, hybrid...). Calculating input impedance.

Continuous signals (definitions, presentation of different existing types, characteristic values). Using Fourier's transform and Laplace's transform to represent different signals. Continuous signal analysis (correlation and auto-correlation functions, amplitude and phase spectrum, energy and power spectrum).

Continuous systems (types, linear and time-independent systems, system functions, transmission function). Analyzing continuous systems using impulse response and convolution. Analyzing continuous systems using Fourier sum and Fourier transformation. Analyzing continuous systems using Laplace's transformation.

Selected references:

Y.S. Shamliv: Continuous-Time Signals, Springer 2006

Desoer and Kuh: Basic Circuit theory, McGraw Hill, 1969

B. P. Lahti: Linear Systems and Signals, Oxford University Press, 2005

P. D. Cha, J. I. Molinder: Fundamentals of Signals and Systems, Cambridge University Press, 2006