Signal processing

Credits: 5 Semester 1 Compulsory: No			
Format	Lectures 25h	Tutorials 15	Private study 85 h

Lecturers: E. Le Carpentier (ECN)

Objectives: To present the methods of description and transformation of deterministic signals for both continuous and discrete time cases. To present also basic knowledge about random signals representation.

Contents:

Analog and digital signal conversion.
Continuous and discrete signal processing.
Linear and nonlinear systems.
Common signal decompositions.
Convolution – its principle and impulse response.
Common impulse responses, convolution properties, correlation.
Fourier transform properties: applications of Fourier transform - spectral analysis of signals, frequency response of systems.
Discrete Fourier transform. Fast Fourier transform.
Introduction to digital filters. Moving average filters. Windowed-sinc filters. De-convolution and optimal filters. Recursive filters. The z-transform and Chebyshev filters. Audio and image processing.
Random signals: summary on random variables: cumulative distribution, probability density function, joint and marginal distributions;

- random signal characterization; basic properties: stationarity, ergodicity, broad-sense stationarity;
- Basic signals: definition and validity domain;
- Time analysis (correlation) and spectral analysis (power spectral density) of stationary signals;
- Fourier analysis, Wiener-Khintchine theorem;

Abilities: The students will be able to:

Represent continuous signals by their discrete equivalents,
Decompose complex signals,
Analyze the signals in Fourier domain,
Design the basic filters for signals processing,
Apply the filter to process the signal,
Analyze random signals

Assessment: 30% continuous assessment, 70% from end of semester examination.

Recommended texts:

[1] Steven W. Smith, *The Scientist and Engineer's Guide to Digital Signal Processing*. Second Edition, California Technical Publishing, San Diego, CA, 1999, on-line: www.dspguide.com.
[2] A.V. Oppenheim, R.W. Schafer, J.R. Buc, *Discrete-Time Signal Processing. Second Edition.* Prentice-Hall 1999.

Further readings: will be provided by lecturer.