CHAIR OF SYSTEM THEORY AND SIGNAL PROCESSING
Prof. Dr.-Ing. Bin Yang

INSTITUTE FOR SYSTEM THEORY AND DISPLAY TECHNOLOGY
UNIVERSITY STUTTGART
Pfaffenwaldring 47, D-70550 Stuttgart
Tel. 0711 / 685 7332 Fax 0711 / 685 7311

Contents of the Lecture "Digital signal processing" (2L+1E)

The English course "Digital signal processing" (DSP) gives an introduction into discrete-time signals and systems. It presents methods for analyzing discrete-time signals and systems. It also describes how to design systems and to process signals for solving practical problems.

Introduction
History of DSP, why DSP, signals and systems, difference between continuous-time and discrete-time sinusoidal signals, aliasing, analog-to-digital conversion, sampling, Nyquest criterion, quantization, digital-to-analog conversion.

Discrete-time signals and systems
Discrete-time signals, classification of signals, discrete-time systems, classification of systems, linear time-invariant and time-variant systems, impulse response, convolution, causality and stability, FIR and IIR systems, linear constant-coefficient difference equation and its solution, non-recursive and recursive systems.

The z-transform
Z-transform, region of convergence, inverse z-transform, properties of the z-transform, transfer function of an LTI system, rational transfer function, poles and zeros, stability, inversion of the z-transform, partial fraction expansion, solving linear constant-coefficient difference equations using z-tranform.

Frequency analysis of signals and systems
Fourier series of continuous-time and discrete-time periodic signals, Fourier transform of continuous-time and discrete-time non-periodic signals, sampling theorem, duality in Fourier series and Fourier transform, properties of the Fourier transform, frequency analysis of discrete-time LTI systems, frequency response and its relation to the transfer function, lowpass, highpass, bandpass, notch filter, comb filter, digital oscillator, linear phase FIR filter, allpass, minimum-phase filter.

The discrete Fourier transform
Discrete Fourier transform (DFT), properties of DFT, circular convolution, filtering based on DFT, fast Fourier transform (FFT), applications of FFT.