

# DIGITAL SIGNAL PROCESSING FUNDAMENTALS

J.S.CHITODE



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Introduction to Signals & Systems : Classification of signals and systems. Properties of discrete time systems. Representation of discrete time signals in terms of weighted impulses. Convolution sum. Methods for finding convolution. Correlation : Cross correlation and auto correlation. Difference equations and differential equations : Solution by classical method, Natural response, Forced response. Finding solution of difference equation by z- transform method. Frequency Response Characteristics of LTI systems : Frequency response of LTI systems, Ideal frequency selective filters, Magnitude and phase response, Group delay, System functions of LTI systems : Stability and causality, Inverse systems, Significance of poles and zeros. Structure of FIR and IIR filters : Structures for discrete time systems, Block diagram representation of linear constant coefficient difference equations, Direct form I, II. Signal flow graph representation of LCCDE, Basic structure for IIR systems, Direct forms, Cascade, Parallel forms, Lattice, Transposed forms. Basic structure for FIR systems, direct form, cascade form. Introduction to Fourier Transform and its significance. Representation of periodic and nonperiodic sequences. The Discrete Time Fourier Transform (DTFT), The discrete Fourier series, properties of DFS, Fourier Transform of Periodic signals, Sampling of Fourier Transform, Fourier representation of finite duration sequences, the discrete Fourier transform, properties of DFT, symmetry properties, Circular convolution, Linear convolution using DFT, Implementation of linear time invariant systems using DFT. Effective computation of DFT. Goertzel algorithm, Radix-2 Decimation in time FFT algorithm, Radix-2 Decimation in frequency algorithm . In place computation, Bit reverse, Alternative forms. IFFT by using DIT and DIF algorithm. FIR Filters Introduction to FIR filters, Linear phase filters, Symmetric and anti symmetric filters, FIR design by Fourier approximation, Window method, Frequency sampling method, Optimal equiripple FIR design. Design of FIR filters using Kaiser Window. IIR Filters Introduction to IIR filters, Butterworth approximation, Chebyshev approximation. Design of IIR filter : Impulse invariance method, Bilinear transformation, Approximation of derivatives method, Least square method, Pade approximation. Frequency transformations : Low pass to high pass, Band pass, Band reject. Comparison between FIR and IIR filters.

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