EE301 : Digital Signal Processing

Course Syllabus for Department Brochure

Sampling and Reconstruction of continuous time signals, Characterization and properties of discrete time signals and systems, Computation of the discrete time Fourier transform and its properties, Computation of the discrete Fourier transform and its properties, Fast Fourier transform algorithms, The Z-transform and its properties, Transform analysis of linear time invariant systems, Implementation of structures for discrete time systems, Digital filter design techniques, Homomorphic filtering, Applications of DSP in speech and image processing.
EE301 : Digital Signal Processing

Detailed Topic Outline

- Sampling and Reconstruction of continuous time signals
  - Periodic sampling, Prefiltering to avoid aliasing, Frequency domain representation of sampling, Reconstruction of a band limited signal from its samples, Changing the sampling rate using discrete time processing, Decimation and Interpolation

- Characterization and properties of discrete time signals and systems
  - Discrete-Time sequences and systems, Properties of linear time-invariant systems, Linear convolution, Eigenfunctions for linear time-invariant systems, Linear constant-coefficient difference equations

- Computation of the discrete time Fourier transform (DTFT) and its properties
  - Representation of sequences by discrete time Fourier transforms, Symmetry properties of the Fourier transform, Fourier transform theorems.

- Computation of the discrete Fourier transform (DFT) and its properties
  - The Fourier transform of periodic signals, Sampling the Fourier transform, The discrete Fourier transform and its properties, Circular and linear convolution using the discrete Fourier transform

- Fast Fourier transform algorithms, The Z-transform and its properties
  - Efficient computation of the discrete Fourier transform, Goertzel algorithm, Decimation-in-Time FFT algorithm, Decimation-in-Frequency FFT algorithm, Z-Transform, Region of convergence of the ZT, and its properties

- Transform analysis of linear time invariant systems
  - The frequency response of LTI systems, Frequency response for rational system functions, All pass and minimum-phase systems
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Indian Institute of Technology Kanpur

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Detailed Topic Outline (Contd.)

- Implementation of structures for discrete time systems
  - Block diagram and signal flow graph representation of linear constant-coefficient difference equations, Basic structures for IIR and FIR systems, Transposed forms

- Digital filter design techniques
  - Design of Discrete-time IIR Filters from Continuous-time Filters, Design of FIR filters by windowing, Brief overview of optimum and equiripple approximation of FIR filters

- Homomorphic filtering and Applications of DSP in speech and image processing
  - Homomorphic deconvolution and the cepstrum, Applications in speech and image processing

Text Books

Primary Text Book
Discrete-Time Signal Processing (Second Edition), Alan V. Oppenheim, Ronald W. Schafer, and John R. Buck, Pearson Education India

Supplementary Text Book

Reference Book for Assignments and Term Project
EE301 : Digital Signal Processing

Detailed Lecture Plan

<table>
<thead>
<tr>
<th>Lecture Number</th>
<th>Lecture Topic</th>
<th>Section No’s in [1]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lec. 1 - Lec. 5</td>
<td>Sampling and Reconstruction of continuous time signals</td>
<td>4.0 - 4.6</td>
</tr>
<tr>
<td>Lec. 6 - Lec. 10</td>
<td>Characterization and properties of discrete time signals and systems</td>
<td>2.0 - 2.6</td>
</tr>
<tr>
<td>Lec. 10 - Lec. 15</td>
<td>Computation of DTFT and its properties</td>
<td>2.7 - 2.9</td>
</tr>
<tr>
<td>Lec. 16 - Lec. 20</td>
<td>Computation of DFT and its properties</td>
<td>8.3 - 8.6</td>
</tr>
<tr>
<td>Lec. 21 - Lec. 25</td>
<td>FFT algorithms, Z-transform and its properties</td>
<td>9.1 - 9.4; 3.0 - 3.4</td>
</tr>
<tr>
<td>Lec. 26 - Lec. 30</td>
<td>Transform analysis of linear time invariant systems</td>
<td>5.3 - 5.6</td>
</tr>
<tr>
<td>Lec. 31 - Lec. 35</td>
<td>Implementation of structures for discrete time systems</td>
<td>6.0 - 6.5</td>
</tr>
<tr>
<td>Lec. 36 - Lec. 40</td>
<td>Digital filter design techniques</td>
<td>7.0 - 7.2</td>
</tr>
<tr>
<td>Two Discussion Hours</td>
<td>Homomorphic Deconvolution Applications in Speech/Image processing</td>
<td>Class Notes</td>
</tr>
</tbody>
</table>

References