230363 - FSP - Fundamentals of Discrete-Time Signal Processing

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications
Academic year: 2017
Degree: MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional)
ECTS credits: 2.5
Teaching languages: English

Teaching staff
Coordinator: Lamarca Orozco, M. Merixell

Teaching methodology
Lectures
Individual work
Matlab simulations

Learning objectives of the subject
To characterize the application of LTI systems for discrete time signal processing in the time domain. To be able to use the Fourier transform, DFT and z-transform for the characterization of signals and systems. To understand the relationship between an analog signal and its discrete-time representation in A/D and D/A conversion. To learn the characterization of random variables (both scalar and multivariate).

Study load

<table>
<thead>
<tr>
<th>Total learning time: 62h 30m</th>
<th>Hours large group:</th>
<th>16h</th>
<th>25.60%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours small group:</td>
<td>4h</td>
<td>6.40%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>42h 30m</td>
<td>68.00%</td>
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</tbody>
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### Content

<table>
<thead>
<tr>
<th>Topic</th>
<th>Learning time</th>
<th>Theory classes</th>
<th>Laboratory classes</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Linear time-invariant systems</strong></td>
<td>6h</td>
<td>2h</td>
<td></td>
<td>4h</td>
</tr>
<tr>
<td><strong>Signals and systems in the frequency domain</strong></td>
<td>24h 30m</td>
<td>6h</td>
<td>2h</td>
<td>16h 30m</td>
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<tr>
<td><strong>Z-transform</strong></td>
<td>12h</td>
<td>3h</td>
<td>1h</td>
<td>8h</td>
</tr>
<tr>
<td><strong>Random variables</strong></td>
<td>14h 30m</td>
<td>5h</td>
<td>1h</td>
<td>8h 30m</td>
</tr>
</tbody>
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#### Description:

- **Linear time-invariant systems**
  - Impulse response. Convolution.
  - Discrete-time systems characterized by difference equations. FIR and IIR systems.

- **Signals and systems in the frequency domain**
  - Discrete-time Fourier transform. Definition, properties, examples and applications.
  - Discrete Fourier Transform (DFT). Definition, properties, examples and applications.

- **Z-transform**
  - Z-transform. Definition, properties, examples.
  - Transfer function of a LTI system. Relationship with its frequency response.

- **Random variables**
  - Random variable concept. Examples: Bernouilli, uniform, Gaussian, exponential.
  - Distribution function. Probability density function.
  - Mean and variance.
Qualification system

Assignments (100%)

Bibliography

Basic:
