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: 2018
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. Meritxell

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: 16h</th>
<th>25.60%</th>
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<tbody>
<tr>
<td></td>
<td>Hours small group: 4h</td>
<td>6.40%</td>
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<tr>
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<td>Self study: 42h 30m</td>
<td>68.00%</td>
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### Content

| **Linear time-invariant systems** | **Learning time**: 6h  
Theory classes: 2h  
Self study: 4h |
|-----------------------------------|------------------|
| **Description**:  
Impulse response. Convolution.  
Discrete-time systems characterized by difference equations. FIR and IIR systems. | |

| **Signals and systems in the frequency domain** | **Learning time**: 24h 30m  
Theory classes: 6h  
Laboratory classes: 2h  
Self study: 16h 30m |
|-----------------------------------------------|-----------------------|
| **Description**:  
Discrete-time Fourier transform. Definition, properties, examples and applications.  
Discrete Fourier Transform (DFT). Definition, properties, examples and applications.  

| **Z-transform** | **Learning time**: 12h  
Theory classes: 3h  
Laboratory classes: 1h  
Self study: 8h |
|-----------------|------------------|
| **Description**:  
Z-transform. Definition, properties, examples.  
Transfer function of a LTI system. Relationship with its frequency response. | |

| **Random variables** | **Learning time**: 14h 30m  
Theory classes: 5h  
Laboratory classes: 1h  
Self study: 8h 30m |
|----------------------|-----------------------|
| **Description**:  
Random variable concept. Examples: Bernouilli, uniform, Gaussian, exponential.  
Distribution function. Probability density function.  
Mean and variance.  
Qualification system

Assignments (100\%)

Bibliography

**Basic:**
