230367 - PC - Polar Codes, From Theory to Practice

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 TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
ECTS credits: 2,5
Teaching languages: English

Teaching staff
Coordinator: Rodriguez Fonollosa, Javier
Others: Rodriguez Fonollosa, Javier

Prior skills
Information Theory (recommended)

Degree competences to which the subject contributes
Specific:
CE1. Ability to apply information theory methods, adaptive modulation and channel coding, as well as advanced techniques of digital signal processing to communication and audiovisual systems.

Teaching methodology
Lectures, application classes, individual project work and exercises.

Learning objectives of the subject
Understand from both the theoretical and practical point of view the construction of Polar Codes.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 62h 30m</th>
<th>Hours large group:</th>
<th>20h</th>
<th>32.00%</th>
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<tbody>
<tr>
<td></td>
<td>Self study:</td>
<td>42h 30m</td>
<td>68.00%</td>
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### Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Learning time</th>
<th>Description</th>
<th>Specific objectives</th>
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<tbody>
<tr>
<td><strong>Introduction and preliminaries.</strong></td>
<td>6h 15m</td>
<td>- Discrete Memoryless source and channel coding theorems.</td>
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<td>- Mutual information and the Bhattachatyya parameter.</td>
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<td><strong>Specific objectives:</strong></td>
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<tr>
<td><strong>Channel Polarization and Polar Codes overview.</strong></td>
<td>12h 30m</td>
<td>- Channel Polarization.</td>
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<td>- Encoding.</td>
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<td>- Decoding.</td>
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<tr>
<td><strong>Source and channel Polarization.</strong></td>
<td>18h 45m</td>
<td>- Polarization Theorem.</td>
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<td>- Entropy versus Bhattachatyya parameter.</td>
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<td>- Block error probability.</td>
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<td>- Achieving capacity of symmetric DMC.</td>
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<td><strong>The wiretap channel.</strong></td>
<td>6h 15m</td>
<td>- Capacity of the wiretap channel.</td>
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<td>- Polar codes for degraded wiretap channels.</td>
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Performance evaluation of polar codes.

Description:
- MATLAB implementation of Polar Codes.
- Performance evaluation.
- Student Implementation assignment.
- Questions /problems session.

Learning time: 18h 45m
- Theory classes: 6h
- Self study: 12h 45m

Qualification system
Individual project work (60%) and exercises (40%).

Regulations for carrying out activities
There is no final exam.

Bibliography

Basic:

Complementary: