EQ2850 Coding for Wireless Communications, Accelerated Program 7.5 credits

Kodning för trådlös kommunikation, forskarförberedande

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for EQ2850 valid from Spring 2019

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

This course is a continuation to the undergraduate courses

- EQ2310 Digital Communications
- EQ2410 Advanced Digital Communications

Among these, EQ2310 is a required prerequisite. Having completed EQ2410 is helpful and therefore recommended, but not a formal requirement. In addition, the following courses are helpful, but not necessary, prerequisites

- EQ2830 Detection and Modulation Theory
- EQ2840 Information Theory and Channel Coding

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

In order to pass the course, the student should be able to:

- Describe the construction, features and operation of modern coding schemes such as low-density parity-check codes and Turbo codes, and decoding algorithms such as the sum-product algorithm, the min-sum algorithm, and the forward-backward algorithm.
- Formulate and use a factor graph representation for describing decoding problems and design of codes on graphs.
- Apply analytical tools, such as density evolution and extrinsic information transfer charts, for performance evaluation and design of modern coding schemes.

To qualify for a higher grade the student should meet the intended learning outcomes required to pass the course, and furthermore be able to:

- Design and compare different modern coding strategies applied to particular communications scenarios, using appropriate analytical tools for performance analysis, and select a justified best choice of coding scheme.
- Explain important theoretical concepts as well as the impact of code properties on the features of the analytical analysis tools mentioned above.

Course contents

The course is focused on **modern error control coding strategies for wireless communications**, with material building on fundamental principles from information theory, communication theory, detection and estimation, and signal processing. A brief outline of the course contents is as follows.

- Factor graphs
- Low-density parity-check (LDPC) codes for binary erasure channels
- LDPC codes for binary memoryless symmetric channels
- Density evolution and extrinsic information transfer (EXIT) charts for LDPC codes
- Convolutional codes and trellis coded modulation
- Turbo codes and generally concatenated codes with iterative decoding

- Bit-interleaved coded modulation and Turbo trellis-coded modulation
- Code design for fading channels
- Rate-compatible coding schemes and rateless coding

Course literature

Tom Richardson and Rüdiger Urbanke, “Modern Coding Theory,” Cambridge University Press 2008.

Examination

- TEN1 - Examination, 7.5 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Other requirements for final grade

Final grade is based on the accumulated score of 8 homework assignments (7.5 credits)

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.