Introduction[1]
Advanced Digital Communications (EQ2410)

https://www.kth.se/social/course/EQ2410/

Ming Xiao

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Tuesday, Jan. 19, 2016
13:00-15:00, E34

[1] Please check the course homepage regularly to inform yourself about changes.

Notes

General Information

Format

- Lectures: $12 * 2$ h; tutorials: $12 * 2$ h
- Homework problems: 2 small projects
- Written exam: 5 h

Course material

- Main textbook: U. Madhow, *Fundamentals of Dig. Comm.*, 2008
- Lecture notes, slides, and handouts
- Collection of problems

Requirements

- Mandatory: written exam
- Voluntary: two sets of homework problems will be distributed

Work load

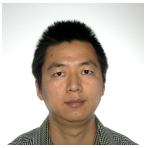
- 6 ECTS credit units
- Wikipedia: "One academic year corresponds to 60 ECTS-credits that are equivalent to 1500-1800 hours of study..."

→ 150-180 hours distributed over 6-8 weeks ("half-time employment").

Notes

Teachers

Course responsible and lectures



- Ming Xiao
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Tutorials

- Dr. German Bassi, Email: germanbassi@gmail.com
- Henrik Forssell, Email: hefo@kth.se

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Content of the Course

Bandlimited Channels and Equalization

- Lecture 1: Channel Model and ML Sequence Estimation
- Lecture 2: Linear Equalization
- Lecture 3: Decision Feedback Equalization

Modern Channel Coding

- Lecture 4: Low-Density Parity-Check (LDPC) Codes
- Lecture 5: Turbo Codes and Iterative Decoding
- Lecture 6: Bandwidth-Efficient Coded Modulation

Wireless Communications

- Lecture 7: Wireless Channels and Diversity
- Lecture 8: OFDM and Channel Capacity
- Lecture 9: Direct-Sequence Spread Spectrum Techniques, CDMA
- Lecture 10: Frequency Hop Spread Spectrum Techniques and Continuous Phase Modulation
- Lecture 11: Space-Time Communications
- Lecture 12: Summary and Modern Communication Standards

Notes

Intended Learning Outcomes

In order to pass the course, you should be able to

- Describe the limiting effects in digital communication systems.
- Explain the basic principles of the transmission techniques.
- Apply the learned transmission techniques to standard problems in digital communications and to evaluate their performance in an analytical/mathematical way.

In order to acquire a higher grade, you should also be able to

- Apply the learned transmission techniques to new and advanced problems, to adapt them appropriately, and to evaluate their performance under these new conditions analytically.
- Combine different techniques and perform an analysis in an analytical/mathematical fashion.

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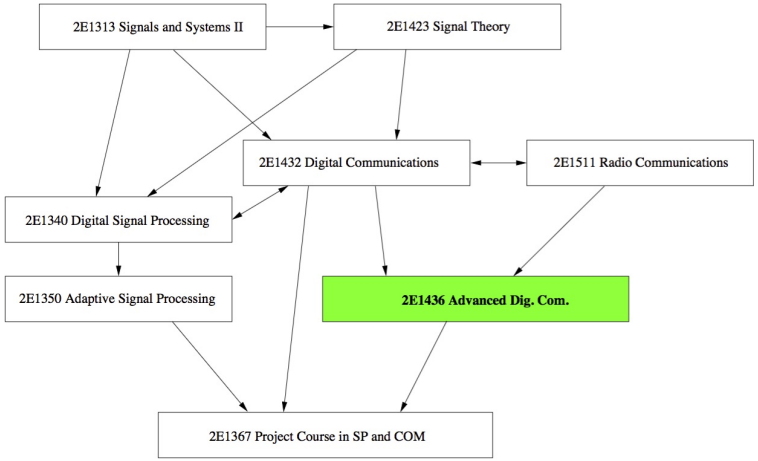
Related Courses



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Lectures

Before the lectures

- The students are expected to prepare for the lectures.
- Preparation includes a reading assignment and a simple (possibly written) preparation tasks which will be used for class-room activities.

During the lectures

1. The teacher presents an overview over the topic, summarizes the main aspects of the reading assignment, and provides additional information if required.
2. In-class activities (group work, student presentations, etc.) based on the preparation assignments address the details of the topic.

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Tutorials

Format

- The teaching assistants (TAs) present the solutions of typical problems.
- The problems are usually chosen from a collection of old exam problems.

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Homework Projects (Voluntary)

Format of the 2 projects

- Mixture of group work (2-4 students) and individual work combining simple programming and problem solving tasks.
- Identify the main components of the transmission system and explain how they are functioning [individual or group task].
- Fix bugs in the software, implement a simple algorithm and add it to the simulation software [group task].
- Verify the results from the simulation analytically using mathematical models if possible, or solve related mathematical problems [individual task].

Registration and groups

- Register for the homework projects by sending an email to:
  mingx@kth.se
- You are invited to propose groups (send a mail to Ming with group members in cc).
- You can register as well as an individual. You will then be assigned to groups by the teachers.

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Homework Projects (Voluntary)

Bonus points on the exam

- Each project will allow the students to earn a maximum of 2 (two) bonus points for the final exam; i.e., in total a maximum number of 4 (four) bonus points can be achieved.
- The group task and the individual tasks will be evaluated separately, where at most one point can be obtained for the group work, and at most one point can be obtained for the individual part.
- Each part will be graded with 0, 0.5, or 1 points.

Deadlines for the projects

- Project 1, "Channel Equalization"
  - Date of assignment (latest): Monday, Jan. 27
  - Submission date: Monday, Feb. 10, 12:00 (noon)
- Project 2, "LDPC Decoding"
  - Date of assignment (latest): Monday, Feb. 10,
  - Submission date: Monday, Feb. 24, 12:00 (noon)
- Note that you cannot expect deadline extensions!

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Final Exam

Format

- Written exam (5 h) with 5 problems
- Each problem can give a maximum of 5 points; a maximum of 25 points can be achieved in the exam.
- The homework projects give extra credit on the mandatory exam.

Pass criterion

- More than 11 (eleven) credits have to be obtained (including the bonus from the homework projects).
- 4 (four) out of 5 (five) exam problems have to be passed with 2 (two) or more credits.

Allowed aids on exam

- Handbooks (mathematical handbooks, e.g. Beta)
- Collection of signal processing formulas (Swedish version)
- The textbook and handouts
- Lecture slides

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