FEM3320 Project Course in Wireless Experimentation 12.0 credits

Projektkurs i trådlösa experiment

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

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

Establishment

Course syllabus for FEM3320 valid from Spring 2013

Grading scale

Education cycle

Third cycle

Specific prerequisites

A documented background in wireless systems similar to the wireless masters program at KTH. One or several publications on topics within wireless communications is preferable.

Language of instruction

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

Intended learning outcomes

After the course, the student should be able to:
• design a wireless system with a physical layer and medium access layer, detailed enough that the performance can be tested on a small-scale wireless testbed including assessing the performance of specific features of the system,
• implement the signal processing blocks in C++ that performs the signal processing associated with the system (using available tools such as IT++),
• understand the major forms of RF signal impairments in real-world wireless systems,
• analyze the performance of their system and compare measurements against theory,
• be able to handle a testbed and make measurements using RF signal generators and spectrum analyzers.

Course contents

• Overview of some wireless testbeds and their purpose
• Our hardware setup
o Units, cables, signals, levels, antennas, control, frequency adjustment.
• The four_multi software framework.
o installing, learning IT++, implementation of a new scheme, necessary files, compiling, the executables, debugging, working with real signals, inter-node communications, thread safety.
• Coding and modulation using four_multi:
o Adaptive coding and modulation (AMC), OFDM, channel state information pilots.
• The example code for the single-input single-output OFDM based implementation called SISO AMC OFDM.
• The example for interference and coordinated multipoint called IA1.
• Exercise on RX and TX modules (XERXES).
• Simulation and experimental evaluation of the example SISO AMC OFDM.
• Development of a MIMO version of SISO AMC OFDM.
• Simulation and experimental evaluation of SISO AMC OFDM.
• Development of a new scheme (preferably related to the students research).
• Simulation of the new scheme.
• Experimental evaluation of the new scheme.
• Presentation of the new scheme, its implementation and simulation and measurement results in a conference-style scientific article.

Disposition

Lectures, simulation exercises, lab exercises, oral student presentations, project work, report writing.

Course literature

• Homepage of four_multi including its user manual.
• XERXES lab description.
• Homepage of IT++.
• Articles with academic implementations of wireless systems.

Equipment

The ACCESS wireless testbed will be used and provided to the students. However, the students will also need access toa personal computer with Ubuntu operating system.

Examination

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.

Other requirements for final grade

• Slides prepared for presenting the first three parts of the four_multi users manual.
• XERXES lab completed.
• Labs on SISO AMC OFDM completed.
• Code for the MIMO developed version of SISO AMC OFDM, and simulation and measurement from it.
• Code for the new approach of the student.
• Measurement results from the new approach.
• Conference style paper describing the new approach, its implementation and a comparison of theoretical and measurement results.

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.