



Course syllabus

Multipelantennsystem Multiple Antenna Systems

EITN10, 7,5 credits, A (Second Cycle)

Valid for: 2023/24

Faculty: Faculty of Engineering, LTH

Decided by: PLED E

Date of Decision: 2023-04-11

General Information

Main field: Communication Systems.

Compulsory for: MWIR2

Elective for: C5-ks, D5, E4

Language of instruction: The course will be given in English

Aim

The aim of this course is to provide a comprehensive treatment of the area of multiple antenna systems for wireless communications. It begins with the theoretical aspects of multiple antenna or multiple-input-multiple-output (MIMO) systems, which predicts huge performance gains in comparison to conventional single antenna systems. The theoretical results provided the momentum for practical implementations, several aspects of which will be covered in the course in order to give an understanding of how the system works in reality.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

be able to establish the key benefits of applying multiple antenna systems

be able to distinguish between different types of multiple antenna systems

be able to explain the role of propagation channel (including effects of antennas) on the capacity of multiple antenna systems

be able to account for the differences in system performance resulting from the possible availability of channel knowledge

be able to identify relevant implementation issues of multiple antenna systems, including practical coding schemes and performance limits/tradeoffs.

Competences and skills

For a passing grade the student must

be able to qualitatively demonstrate the operating principles of multiple antenna systems, under both spatial multiplexing and spatial diversity schemes

be able to calculate the channel capacity of multiple antenna systems for a given setup

be able to quantitatively demonstrate the benefit of spatial diversity

be able to implement, in simulations, different receiver structures and evaluate their respective performance

be able to make use of simulation tools such as Matlab to solve simple design problems with a set of system performance requirements

Judgement and approach

For a passing grade the student must

Have a comprehensive view of how multiple antenna systems influence the system performance and how the technology can be used in wireless links.

Feel confident in the ability to evaluate the use of multiple antenna systems in a given wireless communication scenario.

Contents

The course is presented from an interdisciplinary perspective, across different aspects of the communication systems, including coding/modulation, antennas, propagation channel, medium access control. This is because the performance gains from multiple antenna systems can only be achieved by a holistic consideration of these issues. In particular, the following topics will be presented:

Background of multiple antenna systems and basic concepts

Propagation channel in multiple antenna systems

Capacity of multiple antenna systems

Space-time coding

Receiver structures

Exploiting channel knowledge at the transmitter

Multuser scheme

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)

Assessment: Written examination and assignments.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts

Code: 0110. **Name:** Multiple Antenna Systems.

Credits: 3,5. **Grading scale:** TH. **Assessment:** Approved written exam. **Contents:** Written exam.

Code: 0210. **Name:** Assignments.

Credits: 4. **Grading scale:** UG. **Assessment:** Approved assignments.

Admission

Assumed prior knowledge: EITN75 Wireless System Design Principles and EITN85 Wireless Communication Channels.

The number of participants is limited to: No

Reading list

- Paulraj A, Nabar R, Gore D: Introduction to Space-Time Wireless Communications. Cambridge University Press, 2006, ISBN: 0-521-82615-2.

Contact and other information

Course coordinator: Buon Kiong Lau, buon_kiong.lau@eit.lth.se

Course homepage: <http://www.eit.lth.se/course/eitn10>