E9 231 Jan. 3:0

MIMO Signal Processing

Instructor

Chandra R. Murthy
Email: cmurthy@iisc.ac.in

Teaching Assistant

N/A
Email: N/A

Department: ECE

Course Time: MWF 11am-12pm

Lecture venue: EC1.07

Detailed Course Page: N/A

Announcements

The first class will be held on Monday, Jan. 01, 2018.

Brief description of the course

In this course, we cover the theory, algorithms, and practical considerations in multiple-antenna adaptive wireless communication systems. The topics covered will include the useful results from information theory, parameter estimation theory, array processing, and wireless communications, all specialized to the case of advanced multiple-antenna adaptive processing. We will also discuss

various design issues in ad hoc networks, cognitive radio, and MAC protocols for multiple antenna systems.

Prerequisites

Digital communications, wireless communications, random processes, matrix theory

Syllabus

1. Introduction; channel modeling and mathematical preliminaries

2. Single cell MIMO: channel estimation, data detection, capacity analysis

3. Multi-cell MIMO: pilot contamination, zero forcing/maximum ratio transmission, beamforming, asymptotic analysis

4. Power control principles

5. Case studies

6. Massive MIMO principles; mmWave hybrid beamforming architectures

7. Future directions

Course outcomes

At the end of the course, the student will:

1. Have deep knowledge about the design and analysis of multiple antenna systems

2. Understand different transmission and reception schemes, their advantages and relative performance

3. Using recent results from random matrix theory, analyze the capacity performance of massive MIMO systems

4. Relate the principles learned to recent standardization activities and 5G

Grading policy

10% assignments

20% mid-term

30% project

40% final

Assignments

Assignments will be handed out periodically, typically once in two weeks. They will also be allotted as specific questions/missing steps to fill in during the lectures. Typically, they will be due two weeks after the date they are assigned.

Resources

Daniel W. Bliss and Siddhartan Govindasamy, "Adaptive Wireless Communications: MIMO Channels and Networks,",Cambridge University Press, 2013,

Xiaodong Wang and Vincent Poor, "Wireless Communication Systems:
Advanced Techniques for Signal Reception," Prentice Hall Inc., 2004

Thomas L. Marzetta, Erik G. Larsson, Hong Yang and Hien Quoc Ngo, "Fundamentals of Massive MIMO", Cambridge University Press 2016.