Advanced Wireless Communications: Algorithms and Architectures

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ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Organization

Course structure: 2 parts

- Fundamentals and system architecture of wireless communication systems
- ***Advanced communication algorithms and their implementation***

Course program: Friday, 13:00-16:00

- 2 hours lecture   ELG 120
- 1 hour (computer) exercise   CO 06
  with final project (in groups of 2)

Grading based on

- Mid-term graded exercise (50%)
- Final project, based on research paper study (project and presentation)

Lecture notes

- Slides will be distributed and will be available online

Fundamentals of Wireless Communication

David Tse
Pramod Viswanath

CAMBRIDGE
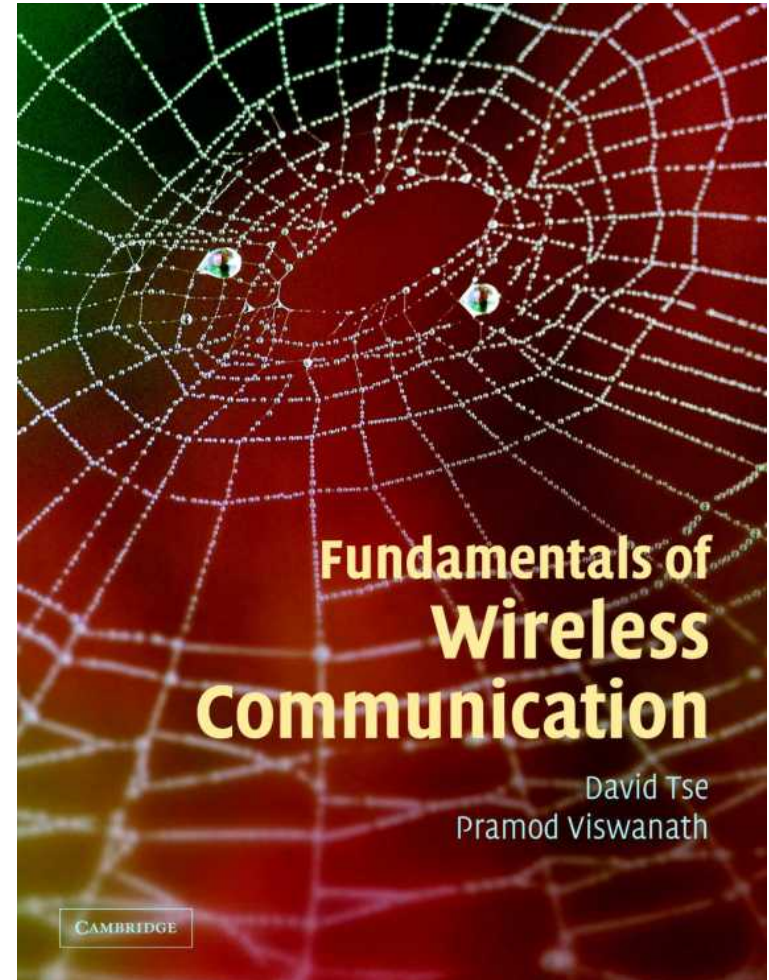
Lecture content

		Lecture	Exercise/Lab
1	22.02.2013	Course outline & OFDM Channel Estimation and Interpolation	Assignment-1: OFDM Channel Estimation
2	01.03.2013	OFDM Synchronization, Tracking, Freq. Offsets	
3	08.03.2013	Diversity and Multiple Antennas	Assignment-2: Diversity
4	15.03.2013	DSSS: Principle, spreading/despreading, processing gain	Assignment-3: DSSS
5	22.03.2013	RAKE Receiver and CDMA	**Assignment-4: CDMA**
6	12.04.2013	Information Theory: Mutual Information and Capacity	**Graded Exercise**
7	19.04.2013	MIMO Communication	Assignment-5: MIMO Capacity
8	26.04.2013	MIMO Detection 1: Linear and SIC receivers	
9	03.05.2013	MIMO Detection 2: Maximum Likelihood Receivers	Assignment-6: MIMO Receivers
10	10.05.2013	MIMO Detection 3: BICM with MIMO	Project
11	17.05.2013	Advanced Channel Codes: LDPC and Turbo Codes	
12	24.05.2013	TBD	
13	31.05.2013	Project Presentation	

Learning objectives

Have the foundations to implement receivers for advanced communication systems and understand the associated implementation tradeoffs

- Obtain a more in-depth understanding of modern wideband communication systems (OFDM and DSSS) and become familiar with the key principles and components

- Obtain a basic understanding of the performance of communication systems and of the performance limitations (Capacity and Diversity)

- Get familiar with the concept and fundamentals of multi-antenna communication systems and corresponding receivers

- Learn some of the fundamentals of information theory and understand how they help you to evaluate the limits and capabilities of communication links

Course Outline and Topics

- OFDM Channel Estimation and Synchronization

- Channel Capacity, Fading Channels, and Diversity

- Bit Interleaved Coded Modulation (BICM)

- Direct Sequence Spread Spectrum Modulation and CDMA

- Multi Antenna Systems and MIMO Spatial Multiplexing

- MIMO Receiver Algorithms and Architectures

- Advanced Channel Coding (Turbo and LDPC codes)

- Iterative Receiver Algorithms and Architectures