Testi del Syllabus

Resp. Did.	**RAHELI Riccardo**	Matricola:	**004444**

Anno offerta:	**2016/2017**
Insegnamento:	**1005255 - WIRELESS COMMUNICATIONS**
Corso di studio:	**5052 - COMMUNICATION ENGINEERING - INGEGNERIA DELLE TELECOMUNICAZIONI**
Anno regolamento:	**2015**
CFU:	**9**
Settore:	**ING-INF/03**
Tipo Attività:	**B - Caratterizzante**
Anno corso:	**2**
Periodo:	**Primo Semestre**
Sede:	**PARMA**

Testi in italiano

Lingua insegnamento	Language English
Contenuti	Outline Channel models. Channel capacity. Diversity techniques. Multiple-input multiple-output (MIMO) systems. Resource allocation techniques.
Testi di riferimento	Reference texbook A. Goldsmith, Wireless communications, Cambridge University Press, 2005.
Obiettivi formativi	Instruction aim 1) Knowledge and understanding The course presents the principles of current wireless communication systems, with a rigorous approach and attention to an operational knowledge. 2) Applying knowledge and understanding Students learn to: - use the main channel models to analyze and design wireless communication systems - use the main diversity, MIMO and resource allocation schemes - evaluate the performance of wireless communication systems - select the most suitable solutions in order to meet specifics in terms of performance and cost, also accounting for possible application constraints.
Prerequisiti	Prerequisites Typical knowledge of a graduate of the Class of Information Engineering are required (first level degree).
Metodi didattici	Instruction methods The course is organized in lectures, excercises and laboratory sessions. Homework assignments complement classroom activity.

Altre informazioni

Other issues

The course relies upon a specific web site.

Modalità di verifica dell'apprendimento

Evaluation methods

Evaluation comprehensively based on:
- Level of active (and regular) participation to classroom lectures, exercises and laboratory activity
- Periodically assigned homeworks
- Final exam including written and oral tests.

Remedial evaluation based on written examination, oral examination and project.

Programma esteso

Detailed outline

1. Channel models (22 h)
   1.1 Review of radio propagation (2 h)
   1.2 Path loss models (5 h)
      Free space
      Flat earth
      Empirical models
      Ray tracing
   1.3 Shadowing model (3 h)
      Lognormal distribution
      Spatial correlation
      Outage probability
   1.4 Fading models (11 h)
      Rayleigh
      Rice
      Nakagami
      Multipath
   1.5 MIMO channel models (1 h)

2. Performance of wireless systems (15 h)
   2.1 Channel capacity (12 h)
      Ergodic capacity with CSIR
      Outage capacity
      Ergodic capacity with CSIT
      Power allocation strategies
      High and low SNR regimes
   2.2 Average error probability (3 h)
      By direct integration
      By the moment generating function
      Alternate representation of the Gaussian tail function

3. Diversity techniques (13 h)
   3.1 Time, frequency and space diversity (1 h)
   3.2 Diversity combining (4 h)
      Selection combining
      Maximal ratio combining
      Equal gain combining
   3.3 Transmit diversity (2 h)
      Maximal ratio transmission with CSIT (beamforming)
      Transmit diversity with CSIR (Alamouti scheme)
   3.4 Performance analysis of diversity systems (6 h)
      Average error probability
      Outage probability
      Outage capacity
      High and low SNR regimes

4. MIMO systems (17 h)
   4.1 Singular value decomposition (3 h)
      Singular values
      Left and right singular vectors
      Parallel decomposition of the MIMO channel
   4.2 Capacity of the deterministic MIMO channel (5 h)

Capacity with CSIT
Water filling in the channel eigenmodes
Degrees of freedom and spatial multiplexing gain
Capacity with CSIR
4.3 Capacity of the fading MIMO channel (3 h)
Capacity achieving distribution with CSIR
High and low SNR regimes
MIMO outage capacity
4.4 Realistic MIMO systems (6 h)
MIMO diversity and beamforming
Diversity-multiplexing tradeoff
Overview of space-time codes and examples
Overview of multiuser MIMO

5. Introduction to OFDM (5 h)
5.1 Realization of OFDM (4 h)
Direct-form
DFT-form
Cyclic-prefixed
5.2 Resource allocation (1 h)
Single-carrier systems
OFDM systems

Testi in inglese

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