



PhD Course

MIMO Wireless Systems: a Random Matrix Theory Approach

by Prof. Marco Chiani

University of Bologna

INFORMATION

- Where: **Aula Magna School of Engineering and Architecture**
Viale del Risorgimento 2 - Bologna
- Date: **8 and 14 March 2016**
- Time: **11:00-13:00 and 14:00-16:00**

Abstract

Multiple antenna systems can exploit the spatial resource to mitigate multipath, to reduce multiuser interference, and to increase spectral efficiency.

After introducing Random Matrix Theory, the course covers the basic principles and applications of multiple antenna systems, including eigenbeamforming, space-time coding, high-throughput MIMO, distributed MIMO, Multi-User MIMO, and massive MIMO. Applications include 5G wireless systems and high-speed wireless LAN.

About the speaker

Marco Chiani (IEEE Fellow) is a Full Professor in Telecommunications at the University of Bologna.

For more information, please visit www.unibo.it/sitoweb/marco.chiani/en

COURSE OUTLINE

Part 1: Introduction to Random Matrices

- Gaussian and Wishart random matrices
- Statistical Inference for Gaussian and Wishart matrices
- Eigenvalues distribution
 - Finite dimension results
 - Asymptotic results: Wigner, Marcenko-Pastur, and Tracy-Widom laws

Part 2: MIMO Systems for Diversity and Interference Mitigation

- Advantages of Multiple Antennas Systems
- Ergodic Capacity, Outage Capacity
- MIMO Channel Models
- Diversity Techniques
 - Receive Diversity
 - Eigenbeamforming
 - Diversity without CSIT: Alamouti's Scheme, Space-Time Codes
- SIMO with Interference: Optimum Combining, MMSE Receivers

Part 3: High-Throughput MIMO Systems

- Capacity of Fixed MIMO Channels
- Diagonalized MIMO by SVD
- Capacity of MIMO Fading Channels
- MIMO Systems for Spatial Multiplexing
 - Closed-Loop MIMO
 - Open-Loop MIMO
- Multiuser MIMO
 - Multiple-Access Channel
 - Broadcast Channel
- Applications
 - Cooperative Communications
 - Virtual MIMO
 - Distributed Antenna Systems
 - Massive MIMO

Final assessment

Written test

(only for those requiring a test certification)

