IC-030: Random matrices and communication systems

Computer, Communication and Information Sciences

(Valid from 01.08.2006)

Instructor	Lévêque Olivier	**Frequency**	Every 2 years

Program(s)/Acad.year	**Total hours**	**Examination procedure**	**ECTS credits**
Computer, Communication and Information Sciences (2006-2007)	Lecture: 4 H hebdo Recitation: 2 H hebdo	Oral presentation	6
Mathematics (edoc) (2006-2007)	Lecture: 4 H hebdo Recitation: 2 H hebdo	Oral presentation	6

Objectives:

- to understand the fundamentals of random matrix theory
- to get familiar with the recent applications to wireless communications
- to get to work on open problems in the field

Content:

1. Course overview and probability review
2. Circulant and Toeplitz deterministic matrices
3. Random matrices: finite-size analysis
4. Application: MIMO channels
5. First asymptotic analysis
6. Universal results
7. Concentration of random matrices
8. Addition and multiplication of random matrices
9. Application: CDMA systems
10. Introduction to free probability
11. Tridiagonal random matrices
12. Other topics (time permitting)

Required prior knowledge:

Good basic notions of probability, linear algebra and information theory

Keywords:

Random matrices, Eigenvalues, Semi-circle law,
Wireless communications, MIMO channels, CDMA systems