



Máster en Ingeniería de Sistemas y Servicios Accesibles para la Sociedad de la Información

E.U.I.T. Telecomunicación

Curso 2009-2010

Seminario

MIMO Mobile Radio Systems



Professor

Prof. Dr.-Ing. habil. Tobias Weber (University of Rostock, Institute of Communications, Germany)

Professional Skills/Knowledge

- MIMO techniques
- OFDM
- CDMA
- Multiuser detection
- Precoding
- Implementation of hardware demonstrators
- Interference reduction
- Signal processing for antenna arrays
- Channel estimation
- Localization of mobile terminals
- Microwave technology

Work Experience

10/2005 to present **Professor**
University of Rostock, Institute of Communications

02/2001 – 10/2005 **Hochschuldozent (senior researcher and lecturer)**
University of Kaiserslautern, Research Group for RF Communications

08/1998 – 02/2001 **Wissenschaftlicher Assistent (senior researcher)**
University of Kaiserslautern, Research Group for RF Communications

06/1996 – 08/1998 **Wissenschaftlicher Mitarbeiter (research assistant)**
University of Kaiserslautern, Research Group for RF Communications

Dates:

16th March – 18th March 2010, Room: 3004

Workload:

1 ECTS

MIMO mobile radio systems attracted much research interest in the communications community in the past ten years. Although first ideas on MIMO trace back to the mid seventies [1], it was not until the publication of the seminal papers by Foschini [2] and Telatar [3] in the mid nineties that extensive research activities started. Now as theory matured first MIMO products are available and MIMO became part of University education.

Contents:

The lecture “MIMO Mobile Radio Systems” gives an introduction to both the theory and the practical system concepts of MIMO mobile radio systems. Due to the time limitations the focus will



be on point-to-point MIMO systems, i.e., multiuser system concepts will be excluded. The lecture consists of three main parts:

Lesson 1, 90 minutes (Tuesday 16th at 15:30h)

Modelling of MIMO systems

In the first part of the lecture after a short introduction the modeling of MIMO systems will be introduced. The main topic of the first part of the lecture is the introduction of the information theoretical basics of MIMO systems. MIMO capacity and key techniques, i.e., waterfilling and singular value decomposition will be discussed.

Lesson 2, 90 minutes (Wednesday 17th at 15:30h)

MIMO channel modelling

The second part of the lecture gives an overview of MIMO channel modeling. Both more realistic geometrical and statistical channel models will be introduced.

Lesson 3, 90 minutes (Thursday 18th at 15:30h)

Practical MIMO system

In the third part of the lecture a bunch of practical MIMO system concepts will be discussed. The lecture will close with a short overview of diversity techniques and space time coding.

The lecture requires some familiarity with linear algebra [4] and basic concepts of communications, probability, random variables and stochastic processes. For further studies the textbook by Tse and Viswanath [5] is recommended.

References

- [1] W. van Etten: An optimum linear receiver for multiple channel digital transmission systems. IEEE Transactions on Communications, August 1975, pp. 828-834.
- [2] G.J. Foschini: Layered Space-Time Architecture for Wireless Communication in a Fading Environment When Using Multi-Element Antennas. Bell System Technical Journal, vol. 1, 1996, pp. 41-59.
- [3] E. Telatar, Capacity of Multi-Antenna Gaussian Channels. European Transactions on Telecommunications, vol. 10, 1999, pp. 585-595.
- [4] P. Petersen: The Matrix Cookbook, <http://matrixcookbook.com/>, 2006.
- [5] Tse, Viswanath: Fundamentals of Wireless Communication, Cambridge, 2005, ISBN 0-521-84527-0