

## MIMO-OFDM SYSTEMS

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### COURSE OBJECTIVE

- To expose the students to understand MIMO-OFDM principles and to study the recent trends adopted in cellular systems and wireless standards.

### COURSE CONTENT

**Sampled Signal Model:** Signal model for SISO, SIMO, MISO and MIMO

**Multipath Fading Channel Models:** ITU Channel Models, 3GPP Channel Models, Extended ITU Models, Spatial Channel Model, SCM Extension Channel Model, WINNER Channel Model

**Capacity & Bit Error Rate Analysis:** Capacity in Frequency Flat Fading channel, Capacity in Frequency Selective Fading Channel, BER Analysis for Space Time Coding, Transmit Beamforming, Receiver Selection Combining, Receiver Equal Combining, Receiver Maximal Ratio Combining

**Channel Estimation :** LS Estimation, MMSE Estimation, Robust MMSE Estimation

**Timing & Frequency Synchronization :** Coarse Time Synchronization, Fine Time Synchronization, Coarse Frequency Synchronization, Fine Frequency Synchronization, Wireless Standards: 3GPP LTE System, WiMAX

### Text Books

- A. Paulraj, R. Nabar and D Gore. "Introduction to Space-Time Wireless Communications", Cambridge University Press, 2003.
- D. Tse and P. Viswanath, "Fundamentals of Wireless Communications", Cambridge University Press, 2005 (First Asian Edition, 2006)
- Y.S. Cho, J. Kim, Won Young Yang, Chung G. Kang, "MIMO OFDM Wireless Communications with MATLAB" John Wiley & sons(Asia) private Ltd, 2010

### Reference Books

- L. Hanzo, Y.A. Li Wang, M. Jiang "MIMO-OFDM for LTE, Wi-Fi and WiMAX", John Wiley & Sons Ltd, 2011
- T.M. Duman, A. Ghrayeb "Coding for MIMO Communication Systems" John Wiley & Sons Ltd, 2007,
- E. Biglieri, R. Calderbank, A. Constantinides, A. Goldsmith, A. Paulraj, "MIMO Wireless communications" Cambridge University press, 2007
- Erik G. Larsson. "Space Time Block Coding for Wireless Communications", Cambridge University Press, 2003

### COURSE OUTCOMES

Students are able to

- CO1: Describe the concepts of MIMO OFDM Wireless communication systems.
- CO2: Determine the capacity and bit error rate of MIMO OFDM system for a given power delay profile of the MIMO channel.
- CO3: Obtain Impulse response coefficients from power delay profile of the SISO, SIMO, MISO and MIMO channels and estimate the channel impulse response using least square, MMSE and Robust MMSE estimation algorithms.
- CO4: Estimate and correct the timing and frequency offset in the signal received in the MIMO OFDM receivers.
- CO5: Analyze the performance of MIMO OFDM physical channel in Wi-Max/LTE wireless standards.

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