MIMO Communication Systems

Course objective: To provide a comprehensive coverage of coding techniques for multiple-input, multiple-output (MIMO) communication systems.

Unit 1: Information Theoretic aspects of MIMO

Review of SISO fading communication channels, MIMO channel models, Classical i.i.d. and extended channels, Frequency selective and correlated channel models, Capacity of MIMO channels, Ergodic and outage capacity, Capacity bounds and Influence of channel properties on the capacity.

Unit 2: MIMO Diversity and Spatial Multiplexing

Sources and types of diversity, analysis under Rayleigh fading, Diversity and channel knowledge. Alamouti space time code, MIMO spatial multiplexing. Space time receivers. ML, ZF, MMSE and Sphere decoding, BLAST receivers and Diversity multiplexing trade-off.

Unit 3: Space Time Block Codes

Space time block codes on real and complex orthogonal designs, Code design criteria for quasi-static channels (Rank, determinant and Euclidean distance), orthogonal designs, generalized orthogonal designs, Quasi-orthogonal designs and Performance analysis.

Unit 4: Space Time Trellis Codes

Representation of STTC, shift register, generator matrix, state-transition diagram, trellis diagram.

UNIT5:

Code construction, Delay diversity as a special case of STTC and Performance analysis.

References

1. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press 2005
2. Hamid Jafarkhani, “Space-Time Coding: Theory and Practice”, Cambridge University Press 2005
3. Paulraj, R. Nabar and D. Gore, “ Introduction to Space-Time Wireless Communications”, Cambridge University Press 2003
4. E.G. Larsson and P. Stoica, “Space-Time Block Coding for Wireless Communications”, Cambridge University Press 2008

5. Ezio Biglieri , Robert Calderbank et al “MIMO Wireless Communications” Cambridge University Press 2007.