PVP 22

ADAPTIVE AND SMART ANTENNAS

22ECMC1T3   **Credits: 4**
Lecture: 4 periods/week   **Internal assessment: 40 marks**
                                                                               Semester end examination: 60 marks

----

Prerequisites: Antennas & Propagation

Course Outcomes:

At the end of the course Student will be able to

- Understand the concepts of smart antenna and adaptive antennas
- Learn different adaptive algorithms for the smart antennas
- Understand the direction of arrival estimation methods to combat fading in mobile communication.
- Learn the time-space processing of the antennas.

UNIT-I

Smart Antennas: Introduction, Need for Smart Antennas, Overview, Smart Antenna Configurations, Space Division Multiple Access (SDMA), Architecture of a Smart Antenna System, Benefits and Drawbacks, Basic Principles, Mutual Coupling Effects

DOA Estimation Fundamentals: Introduction, Array Response Vector, Received Signal Model, Subspace-Based Data Model, Signal Auto covariance Matrices, Conventional DOA Estimation Methods, Subspace Approach to DOA Estimation: MUSIC Algorithm, ESPRIT Algorithm. Uniqueness of DOA Estimates.

UNIT-II

Beamforming Fundamentals: Classical Beam former, Statistically Optimum Beamforming Weight Vectors- Maximum SNR Beam former, Multiple Side lobe Canceller and the Maximum SINR Beam former, Minimum Mean Square Error (MMSE), Direct Matrix Inversion (DMI), Linearly Constrained Minimum Variance (LCMV).Adaptive Algorithms for Beamforming- Least Mean-Square (LMS) Algorithm, Recursive Least-Squares (RLS) Algorithm, Constant-Modulus (CM) Algorithm, Affine-Projection (AP) Algorithm, Quasi-Newton (QN) Algorithm.

UNIT-III

Integration and Simulation of Smart Antennas: Overview, Antenna Design, Mutual Coupling, Adaptive Signal Processing Algorithms, Trellis-Coded Modulation (TCM) for Adaptive Arrays, Smart Antenna Systems for Mobile Ad Hoc networks (MANETs).

UNIT-IV

Space–Time Processing: Introduction, Discrete Space–Time Channel and Signal Models, Space –Time Beamforming, Inter symbol and Co-Channel Suppression, Space – Time Processing for DS-CDMA, Capacity and Data Rates in MIMO Systems.

PVP 22

Learning Resources

Text Books

1. C. A. Balanis and P. I. Ioannides, "Introduction to smart antennas" Morgan & Claypool Publishers, 2007

2. Robert A Monzingo, Randy L.Haupt and Thomas W.Miller, Introduction to Adaptive Arrays, 2nd Ed., Yesdee publishers

Reference Books

1. S. Chandran, Adaptive antenna arrays, Trends and Applications, Springer, 2009

E-Resources

https://nptel.ac.in/courses/117107035