

NOC: Estimation for Wireless Communications , MIMO/ OFDM Cellular and Sensor Networks (Course sponsored by Aricent) - Video course

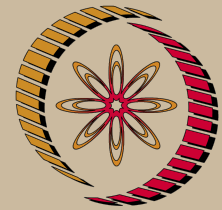
COURSE OUTLINE

Estimation theory provides a wide variety of tools and techniques which form the basis for several key applications in modern wireless communications and signal processing. Various signal processing procedures in communication systems such as channel estimation, equalization, synchronization etc., which are also employed in MIMO-OFDM based 3G/ 4G wireless systems, are based on fundamental concepts in estimation theory. Further, recent research developments in areas such as wireless sensor networks also employ several tools from estimation theory towards distributed parameter estimation etc. Therefore, principles of estimation are naturally of a significant interest in research and industry.

A clear grasp of the basic principles of estimation can significantly enhance understanding by providing deeper insights into various techniques in signal processing and communication. Beginning with a brief overview of the basic concepts of maximum likelihood (ML) and Least Squares Estimation (LS), this course will comprehensively cover several applications of estimation theory in wireless communications such as channel estimation, equalization, MIMO, OFDM. Further, we will also cover Bayesian Estimation, MMSE, LMMSE and illustrate applications in wireless sensor networks and other allied applications such as Radar.

COURSE DETAIL

Week .No	Topic
1	Basics of Estimation, Maximum Likelihood (ML), Properties – Mean/ Variance of Estimate
2	Wireless Flat-Fading Channel Estimation, Pilot-based ML Estimate, Properties, Example of Channel Estimation.
3	Cramer-Rao Bound (CRB), Vector Parameter Estimation, Multi-Antenna Downlink Mobile Channel Estimation
4	Least Squares (LS) Principle, Pseudo-Inverse, Properties of LS Estimate, Examples – Multi-Antenna Downlink and MIMO Channel Estimation.
5	Inter Symbol Interference (ISI), Channel Equalization, Zero-Forcing (ZF) Equalizer, ZF Example
6	Introduction to Orthogonal Frequency Division Multiplexing (OFDM) and Pilot Based OFDM Channel Estimation, Example



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Electronics & Communication Engineering

Pre-requisites:

- BE/ME/MS /PhD can be allowed
- Basic knowledge of,
 - Probability, random variables
 - Linear Algebra, DSP

Additional Reading:

Fundamentals of Statistical Signal Processing - Author: Steven M. Kay - Volume I: Estimation Theory

Coordinators:

Prof. Aditya K. Jagannatham
Dept. of Electrical Engineering IIT Kanpur

7	OFDM – Comb Type Pilot (CTP) Transmission, Channel Estimation in Time/ Frequency Domain, CTP Example, Frequency Domain Equalization (FDE), Example-FDE
8	Sequential Least Squares (SLS) Estimation – Scalar/ Vector Cases, Applications- Wireless Fading Channel Estimation, SLS Example.

