

DETECTION AND ESTIMATION THEORY

Module 1: Fundamentals of Detection Theory

Hypothesis Testing: Bayes' Detection, MAP Detection, ML Detection, Minimum Probability of Error Criterion, Min-Max Criterion, Neyman-Pearson Criterion, Multiple Hypothesis, Composite Hypothesis Testing: Generalized likelihood ratio test (GLRT), Receiver Operating Characteristic Curves.

Module 2: Fundamentals of Estimation Theory

Role of Estimation in Signal Processing, Unbiased Estimation, Minimum variance unbiased(MVU) estimators, Finding MVU Estimators, Cramer-Rao Lower Bound, Linear Modeling-Examples, Sufficient Statistics, Use of Sufficient Statistics to find the MVU Estimator

Module 3: Estimation Techniques

Deterministic Parameter Estimation: Least Squares Estimation-Batch Processing, Recursive Least Squares Estimation, Best Linear Unbiased Estimation, Likelihood and Maximum Likelihood Estimation

Random Parameter Estimation: Bayesian Philosophy, Selection of a Prior PDF, Bayesian linear model, Minimum Mean Square Error Estimator, Maximum a Posteriori Estimation

State Estimation: Prediction, Single and Multistage Predictors, Filtering, The Kalman Filter

References:

1. M D Srinath, P K Rajasekaran, R Viswanathan, Introduction to Statistical Signal Processing with Applications, "Pearson"
2. Steven M. Kay, "Statistical Signal Processing: Vol. 1: Estimation Theory, Vol. 2: Detection Theory," Prentice Hall Inc., 1998.
3. Jerry M. Mendel, "Lessons in Estimation Theory for Signal Processing, Communication and Control," Prentice Hall Inc., 1995
4. Ralph D. Hippenstiel, "Detection Theory- Applications and Digital Signal Processing", CRC Press, 2002.
5. Bernard C. Levy, "Principles of Signal Detection and Parameter Estimation", Springer, New York, 2008.
6. Harry L. Van Trees, "Detection, Estimation and Modulation Theory, Part 1 and 2," John Wiley & Sons Inc. 1968.
7. Neel A. Macmillan and C. Douglas Creelman, "Detection Theory: A User's Guide (Sec. Edn.)" Lawrence Erlbaum Associates Publishers, USA, 2004.
8. Monson H. Hayes, "Statistical Digital Signal Processing and Modelling," John Wiley & Sons Inc., 1996.