

Adaptive Signal Processing (3 – 0 – 0)

MODULE – I

(11 hours)

Adaptive System: Definition and Characteristics, Areas of Application, Example of an Adaptive System, Adaptive Linear Combiner, The Performance Function, Gradient and Minimum Mean-Square Error, Alternative Expression of the Gradient, Decorrelation of Error and Input Components. [Read Widrow: Chapter 1 and 2]

Winer Filter: Linear Optimum Filtering, Principle of Orthogonality, Minimum Mean Square Error, Winer-Hopf Equation, Error Performance Surface. [Read Haykin: Chapter 2.1-2.5]

Linear Prediction: Forward Linear Prediction, Backward Linear Prediction, Properties of Prediction Error Filters. [Read Haykin: Chapter 3.1, 3.2, 3.4]

MODULE – II

(11 hours)

Method of Steepest Descent: Basic Idea of Steepest-Descent Algorithm, Steepest-Descent Algorithm Applied to Winer Filter, Stability of Steepest-Descent Algorithm, Limitations of Steepest-Descent Algorithm. [Read Haykin: Chapter 4.1 – 4.3, 4.6]

Least-Mean Square Adaptive Filter: Overview, LMS Adaptation Algorithm, Application, Comparison of LMS With Steepest-Descent Algorithm. [Read Haykin: Chapter 5.1 – 5.3, 5.5]

Normalized Least-Mean Square Adaptive Filter: Normalized LMS Filter as the Solution to Constrained Optimization Problem, Stability of the NLMS. [Read Haykin: Chapter 6.1, 6.2]

MODULE – III

(11 hours)

Frequency-Domain and Subband Adaptive Filters: Block Adaptive Filters [Read Haykin: Chapter 7.1]

RLS Adaptive Filters: Statement of Linear Least-Square Estimation Problem, Matrix Inversion Lemma, The Exponentially Weighted RLS Algorithm. [Read Haykin: Chapter 8.1, 9.1 – 9.3]

Kalman Filter: Recursive Minimum Mean-Square Estimation For Scalar Random Variable, Kalman Filtering Problem, Initial Conditions, Summary of Kalman Filter. [Read Haykin: Chapter 10.1, 10.2, 10.6, 10.7]

Text Books

1. Bernard Widrow and Samuel D. Stearns, Adaptive Signal Processing, Pearson Education
2. Simon Haykin, Adaptive Filter Theory (Fourth Edition), Pearson Education

Reference Books

- 1.