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Future Vision

By K B Hemanth Raj

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| ADAPTIVE SIGNAL PROCESSING B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering [As per Choice Based Credit System (CBCS) Scheme] | | | |
|---|------------------------------|-------------------|-----------|
| Course Code | 17EC652 | CIE Marks | 40 |
| Number of Lecture Hours/Week | 03 | SEE Marks | 60 |
| Total Number of Lecture Hours | 40 (8 Hours / Module) | Exam Hours | 03 |
| CREDITS – 03 | | | |
| Course Objectives: The objectives of this course are to: <ul style="list-style-type: none"> • Introduce to the concept and need of adaptive filters and popular adaptive signal processing algorithms • Understand the concepts of training and convergence and the trade-off between performance and complexity. • Introduce to common linear estimation techniques • Demonstrate applications of adaptive systems to sample problems. • Introduce inverse adaptive modelling. | | | |
| Module-1 | | | |
| Adaptive systems: Definitions and characteristics - applications – properties-examples - adaptive linear combiner input signal and weight vectors - performance function-gradient and minimum mean square error - introduction to filtering-smoothing and prediction - linear optimum filtering-orthogonality - Wiener – Hopf equation-performance surface(Chapters 1& 2 of Text). L1, L2 | | | |
| Module-2 | | | |
| Searching performance surface-stability and rate of convergence: Learning curve-gradient search - Newton's method - method of steepest descent - comparison - Gradient estimation - performance penalty - variance - excess MSE and time constants – mis-adjustments (Chapters 4& 5 of Text). L1, L2 | | | |
| Module-3 | | | |
| LMS algorithm convergence of weight vector: LMS/Newton algorithm - properties - sequential regression algorithm - adaptive recursive filters - random-search algorithms - lattice structure - adaptive filters with orthogonal signals (Chapters 6 & 8 of Text). L1, L2, L3 | | | |
| Module-4 | | | |
| Applications-adaptive modeling and system identification: Multipath communication channel, geophysical exploration, FIR digital filter synthesis. (Chapter 9 of Text). L1, L2, L3 | | | |
| Module-5 | | | |
| Inverse adaptive modeling: Equalization, and deconvolution adaptive equalization of telephone channels-adapting poles and zeros for IIR digital filter synthesis (Chapter 10 of Text). L1, L2, L3 | | | |
| Course Outcomes: At the end of the course, students should be able to: <ul style="list-style-type: none"> • Devise filtering solutions for optimising the cost function indicating error in estimation of parameters and appreciate the need for adaptation in design. • Evaluate the performance of various methods for designing adaptive filters through estimation of different parameters of stationary random process clearly considering practical application specifications. | | | |

- Analyse convergence and stability issues associated with adaptive filter design and come up with optimum solutions for real life applications taking care of requirements in terms of complexity and accuracy.
- Design and implement filtering solutions for applications such as channel equalisation, interference cancelling and prediction considering present day challenges.

Text Book:

Bernard Widrow and Samuel D. Stearns, "Adaptive Signal Processing", Person Education, 1985.

Reference Books:

1. Simon Haykin, "Adaptive Filter Theory", Pearson Education, 2003.
2. John R. Treichler, C. Richard Johnson, Michael G. Larimore, "Theory and Design of Adaptive Filters", Prentice-Hall of India, 2002.