

13EC532 MATHEMATICAL METHODS FOR SIGNALS AND SYSTEMS

SYLLABUS

Mathematical Models and Vector Space Concepts: Mathematical models for linear systems and signals, Vector spaces and linear algebra: norms, Hilbert and branch spaces, linear transformations, projections and orthogonalization of vectors. **Least Square and Minimum Mean Square Filtering and Estimation:** Approximation problem in Hilbert space, Orthogonality principle, Matrix representation of least square problems, Minimum error in Hilbert-space approximations, Least squares filtering, Minimum mean square estimation, MMSE filtering, Comparison of least squares and minimum mean squares, Frequency-domain optimal filtering, Minimum-norm solution of underdetermined equations, Iterative reweighted LS for L_p optimization. **Linear Operators and Matrix Inverses:** Linear operators, Operative norms, Adjoint operators and transposes, Geometry of linear equations, Four fundamental sub spaces of a linear operator, Pseudo inverses, Inverse of a block matrix. **Eigen values and Eigen vectors:** Eigen values and linear systems, Linear dependence of eigenvectors, Diagonalization of a matrix, Geometry of invariant subspaces, Geometry of quadratic forms subject to linear constraints, Karhunen-Loève approximations, Eigen filters, Signal subspace techniques. **Singular Value Decomposition:** Theory of SVD, Matrix structure from the SVD, Pseudo inverses, Numerically sensitive problems, Rank-reducing approximations. Applications of the SVD: System Identification, Total least square problems, Partial total least squares, Rotation of subspaces, Computation of SVD.

TEXT BOOKS

1. Todd K. Moon, Wynn C. Stirling, 'Mathematical Methods and Algorithms for signal processing', Pearson education.
2. Statistical Signal Processing of Complex-Valued Data, Peter J. Schreier and Louis L. Scharf, Cambridge University Press

REFERENCE TEXT BOOKS

1. Steven M. Kay, Intuitive Probability and Random Processes using Matlab, Springer, 2006.
2. Richard E. Blahut, Fast Algorithms for Signal Processing Cambridge University Press
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