ENGR 5022
Engineering Analysis and Applications

TEXT:

Classnotes

The Student Edition of MATLAB, Mathworks.

TOPICS:

1. Linear Vector Space

   Vector space, Metric space, norm, scalar product, manifold, linear independence, subspace, projection, basis, orthogonality, null space, minimum norm solution, minimum error solution, singular value decomposition, least square and recursive least square estimation, prediction.

2. Functions and Function Spaces

   Space of continuous functions, L_2 space, metric space, Hilbert space, norm and scalar product, fixed point theorem, orthogonality, generalized Fourier series.

3. Linear Transformation

   Tansformations and mappings, change of basis, adjoint transformation, rank, norm, determinant, null space, eigenvalue, eigenvector, generalized eigenvectors, diagonalization, Jordan canonical form, Sturm-Liouville problem.

4. System Representation

   Systems representation in finite dimensional state space, system representation in infinite dimensional state space, properties of solution, dependence of solution on system parameters, sensitivity, examples of distributed parameter systems.

5. Random Processes

   Random processes, mean and variance, Gaussian processes, systems driven by random processes.

6. Optimization

   Linear functionals, Gateaux and Frechet differential, least square minimization, steepest descent method, conjugate gradient method, constrained optimization.

7. Complex Analysis

   Analytic functions, conformal mapping, complex integration, Cauchy theorem, Laurent series, Taylor series, residue theorem, Nyquist criterion.

Grading

Grading of the course will be based upon the following:

Term Test	20%
Homeworks and Project	50%
Final Exam	30%

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