1. Conceptual Understanding

By the end of this course, students will be able to:

1.1. Explain the relationships between systems of linear equations, augmented matrices, vector equations, matrix equations, and row reduction technique.

1.2. Explain the relationship between the solution set of a consistent nonhomogeneous linear system and the solution set of the corresponding homogeneous linear system.

1.3. Use the concepts of pivot positions and pivot columns to analyze the existence and uniqueness of solutions to a linear system.

1.4. Describe the properties of vector spaces and subspaces, including null spaces and column spaces, and explain their significance.

1.5. Explain the intuition behind linear independence and determine whether a set of vectors is linearly independent.

1.6. Define a basis for a vector space and explain the significance of having a basis.

1.7. Interpret matrix-vector multiplication as a linear transformation and analyze how matrices represent linear transformations.

1.8. Analyze the role of eigenvalues and eigenvectors in diagonalization and justify their significance.

1.9. Explain what a least-squares problem is and apply orthogonality concepts to solve least-squares problems.

2. Computational Skills

By the end of this course, students will be able to:

2.1. Solve systems of linear equations using the row reduction algorithm and express the solutions in parametric vector form.

2.2. Perform operations on matrices, including addition, multiplication, and inversion, and evaluate their theoretical significance.

2.3. Compute determinants and use them to assess invertibility.

2.4. Find eigenvalues and eigenvectors of matrices and apply them to diagonalize matrices.

3. Computational Tools

By the end of this course, students will be able to:

3.1. Use MATLAB to solve systems of equations and compute eigenvalues.

3.2. Develop scripts to visualize solutions to homogeneous and nonhomogeneous linear systems.

3.3. Visualize vector operations and linear transformations to gain deeper insights into theoretical concepts.

3.4. Leverage MATLAB to analyze and solve large-scale problems that are impractical to handle manually.