

Course Syllabus

Text: “Numerical Linear Algebra ”, by L. Trefethen and D. Bau, III, SIAM

The following lectures from the text (and other sources) will be covered:

Part I: Fundamentals

- Lecture 1** Matrix-Vector Multiplication
- Lecture 2** Orthogonal Vectors and Matrices
- Lecture 3** Norms
- Lecture 4** The Singular Valued Decomposition
- Lecture 5** More on the SVD

Part II: QR Factorization and Least Squares

- Lecture 6** Projectors
- Lecture 7** QR Factorization
- Lecture 8** Gram-Schmidt Orthogonalization
- Lecture 9** MATLAB
- Lecture 10** Householder Triangularization
- Lecture 11** Least Squares Problems

Part III: Conditioning and Stability

Selected topics from this part will be covered as needed for parts IV, V, and VI

Part IV: Systems of Equations

- Lecture 20** Gaussian Elimination
- Lecture 21** Pivoting
- Lecture 22** Stability of Gaussian Elimination
- Lecture 23** Cholesky Factorization

Part V: Eigenvalues

- Lecture 24** Eigenvalue Problems
- Lecture 25** Overview of Eigenvalue Algorithms
- Lecture 26** Reduction of Hessenberg or Tridiagonal Form
- Lecture 27** Rayleigh Quotient, Inverse Iteration
- Lecture 28** QR Algorithm without Shifts
- Lecture 29** QR Algorithm with Shifts
- Lecture 30** Other Eigenvalue Algorithms
- Lecture 31** Computing the SVD

Part VI: Iterative Methods

- Lecture 32** Overview of Iterative Methods
- Lecture 38** Conjugate Gradients
- Lecture 40** Preconditioning

Remark: The following topics, while introduced in the text, are not covered in detail, additional resources will be used / provided

- Lecture A1** Jacobi Iteration
- Lecture A2** Gauss - Siedel Iteration
- Lecture A3** SOR
- Lecture A5** Other Methods for Linear Systems