

Topics for the Graduate Exam in Numerical Analysis 502a

Most of the following topics are normally covered in the course Math 502a.

1. Direct Methods for Linear systems.
 - Gaussian Elimination and LU Factorization
 - Banded Systems
 - Symmetric Matrices
 - Perturbation Theory and Error Analysis

2. Matrix Eigenvalue Problems.
 - Canonical Forms
 - Perturbation Theory
 - Jacobi Methods
 - The Power Method (including Inverse and Rayleigh Quotient iterations)
 - Eigenvalues of Condensed Matrices (including unitary elementary transformations, reduction to Hessenberg form, QR algorithm)
 - Singular Value Decomposition (SVD)

3. Linear Least Squares Problems.
 - The Method of Normal Equations
 - Least Squares and the SVD (including pseudoinverse solutions)
 - Orthogonal Decompositions

4. Iterative Methods for Linear Systems
 - Stationary Iterative Methods (Jacobi and Gauss-Seidel)
 - Successive Overrelaxation Methods (including convergence analysis)
 - The Conjugate Gradient Method
 - Preconditioned Methods

References:

G. Dahlquist and A. Bjorck, Numerical Mathematics, SIAM, 203
L.N. Trefethen and D. Bau, Numerical Linear Algebra, SIAM, 1997
J.W. Demmel, Applied Numerical Linear Algebra, SIAM, 1997
W. Cheney and D. Kincaid, Numerical Analysis, Brooks/Cole, 1996
E.K. Blum, Numerical Analysis, Addison-Wesley, 1972