198:510 Numerical Analysis, FALL 2012

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• Office Hours: Tuesday and Thursday, 2-3PM (Tonde, M,W 3:10-4:10)
• Course Homepage: http://www.cs.rutgers.edu/~steiger/cs510.html

• Objectives, Prerequisites, Expected work: Introduction to general issues arising in scientific computing and to specific algorithms for some important computational tasks; you will need Calculus, Linear Algebra, and the ability to program in a high level language, e.g., C, C++, Fortran, Matlab; grades will be based on regular written homework and 2-3 small programs (≤ 1/5) and two exams (≥ 4/5).

• Topics:
  1. Floating point numbers and roundoff error
  2. Nonlinear Equations
     (a) bisection method, regla falsi, fixed point iteration, secant method, Newton’s method
     (b) convergence rates
     (c) system of nonlinear equations - Newton’s method
  3. Linear Systems
     (a) Gaussian elimination/ LU decomposition/ matrix inversion
     (b) complexity
     (c) error analysis, norms, condition number
     (d) iterative methods - Jacobi, Gauss-Seidel, SOR
     (e) Singular Value decomposition
  4. Polynomial Approximation and Interpolation
     (a) The interpolating polynomial and its error
     (b) Tchebycheff interpolation, minimax approximation
     (c) splines
     (d) least squares approximation, orthogonal polynomials
  5. Numerical Differentiation and Integration
  6. Numerical Solution of Differential Equations

• References: