**Numerical Analysis I** (Sept. 2010)

**Text:** We will use course notes which can be downloaded from the course web page.

**Course Description:** This course will cover the following:

1. (3 hours) Brief introduction to mathematical modeling and to MATLAB programming. (A good additional reference is: *MATLAB Guide*, by D. J. Higham and N. J. Higham, SIAM, 2000.)

2. (5 hours) Solving a nonlinear equation in one unknown: Bisection, Newton's method, the secant method, fixed points and functional iteration, rates of convergence.

3. (5 hours) Floating point arithmetic: Computer representation of numbers, IEEE floating point standard, rounding, perturbation analysis, backward error analysis. Conditioning of problems, stability of algorithms. (A good additional reference is: *Numerical Computing with IEEE Floating Point Arithmetic*, by Michael L. Overton, SIAM, 2001.)

4. (6 hours) Numerical solution of linear equations: Theory of linear systems, triangular systems, Gaussian elimination, considerations for parallel computing, conditioning and sensitivity of linear systems. Least squares.

5. (5 hours) Polynomial and piecewise polynomial interpolation: Lagrange and Newton forms of the interpolant. Interpolation at Chebyshev points and the `chebfun` package for MATLAB. Piecewise linear interpolation, cubic Hermite interpolation, cubic splines.