MATH 6610-1: ANALYSIS OF NUMERICAL METHODS I
FALL 2005

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Course URL: `http://www.math.utah.edu/~zhu/6610.html`

Time and Place: MWF 11:50 am - 12:40 pm, JWB 208

Office Hours: MWF 2:00 - 3:00 pm, or by appointment

Text: *Applied Numerical Linear Algebra,* J. W. Demmel, SIAM Publications.

Other Recommended Reading:

1. *Matrix Computations,* G. Golub and C. Van Loan, 3rd Edition, Johns Hopkins University Press.
2. *Numerical Linear Algebra,* L. Trefethen and D. Bau, III. SIAM Publications.

Prerequisites: Good knowledge of linear algebra and some familiarity with MATLAB.

Course Outline: Techniques in scientific computing are not just a collection of recipes to be carried in a toolbox, nor should they be studied in self-contained manners with a collection of theorems and proofs. Integrated with modern research and development in general, fields in numerical analysis develop along many directions. The needs for rigorous analysis are motivated by the difficulties and practical requirements of the application. In this course, we will highlight those problems where naive numerical approaches would often fail and the application calls for a careful analysis so we will reach the solution accurately and efficiently, with confidence.
The subjects we will cover in this semester are those in numerical linear algebra: systems of linear equations, least square problems, eigenvalue problems, and singular value decomposition. First of all, we will identify the source of the problem, and investigate connections with other applications. Then we will target the numerical issues, learn about the available techniques, choose the best approach, and assess the results. To achieve this, we will focus on the following issues for each of the subject:

1. matrix factorization,
2. perturbation theory and condition numbers,
3. effects of roundoff error (such as floating point arithmetic),
4. the speed and complexity of an algorithm,
5. choosing the appropriate algorithm for the problem, and
6. making good use of existing numerical software.

Grading: Consists of a comprehensive take-home final: (40%) and weekly assignments (60%). Assignments will be given on every Monday and collected on the following Monday. Programming is required in many of the assignments and it is expected that students work on the MATLAB platform. All programming works should be submitted by e-mail.