Matrix Computations – COMP6839

Preliminary Syllabus - Spring 10 (Graduate Course)

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- **Course Description and Objective:**
  Research into the areas of applied mathematics and scientific computing often encounters matrix computation problems. In this course you will learn advanced techniques for solving linear equations and computing eigenvalue problems, etc. This course will help you do better research if you involve matrix related computations. **The instructor will provide you the class material.**
- **Textbook**: G. Golub and C. VanLoan, "Matrix Computations", Johns Hopkins University Press, Baltimore, Third Edition.
- **Credit Number**: **3**
- **Prerequisites:** Calculus, Linear Algebra
- **Expected Work:** Homework (= 1/3); One midterm exam and Final project(= 2/3).

- **The Covering Topics:**

  1. *Basic Concepts*: Matrix norms, Vector norms, Orthogonality and the SVD. The sensitivity of square least systems, etc.
  2. *Linear Systems*: Triangular systems, LU factorization, LDM^t factorization, Positive definite systems, Banded systems, Vandermonde systems, Toeplitz and related systems;
  3. *Orthogonalization and Least Squares*: Householder and Givens matrices, OR factorization, The full rank LS problem.
  4. *The Unsymmetric Eigenvalue Problem*: Power method, The Hessenberg and real Schur forms, The practical QR algorithm.
  5. *The Symmetric Eigenvalue Problem*: Power Iterations, QR algorithm, Jacobi method, Tridiagonal methods, Computing the SVD.
  6. *Lanczos Method, Iteration Methods, Functions of Matrices etc*

- **References:**

1. Roger A. Horn and Charles R. Johnson, "Topics in Matrix Analysis", Cambridge University Press, 1999.