Theoretical Questions for the course

Numerical Linear Algebra

TMA265/MMA600

- Perturbation theory.
- Gaussian elimination.
- The need of pivoting.
- Improving the accuracy of a solution.
- Real symmetric positive definite matrices.
- Band matrices.
- Matrix factorizations that solve the linear least squares problem: normal equations, QR decomposition, SVD decomposition.
- Least squares problems and methods for their solution: the method of normal equations, QR and SVD decomposition.
- Orthogonal matrices. Householder transformations.
- Givens rotations.
- QR-factorization by Householder transformation and Givens rotation.
- Tridiagonalization of matrix by Householder transformation and Givens rotation.
- Rank-deficient least squares problems.
- Moore- Penrose pseudoinverse A^+.
- Solving rank-deficient least squares problems using QR with pivoting.
- Nonsymmetric eigenvalues problems. Jordan and Shur Canonical forms.
- Computing eigenvectiors from Shur form.
- Gerschgorin's theorem, Bauer-Fike theorem.
- Algorithms for the nonsymmetric eigenproblems:power method, inverse iteration, QR iteration, Hessenberg reduction, tridiagonal and bidiagonal reduction.
- Regular matrix pencils and Weierstrass canonical form.
- Algorithms for symmetric eigenproblems: Tridiagonal QR iteration, Rayleigh quitient iteration, Divide-and-conquer algorithm. QR iteration with Wilkinson's shift, bisection and inverse iteration algorithms, Jacobi's method.
- Algorithms for the SVD: QR iteration, LR iteration, divide-and-conquer, bisection and inverse iteration, Jacobi's method for the SVD, one-sided Jacobi.
- The basic iterative methods (Jacobi, Gauss-Seidel and Successive overrelaxation (SOR)) for solution of linear systems.
- Preconditioning for Linear Systems.