Part IB - Easter Term 2003

Numerical Analysis I

1. Course description

Here is an *approximative* content of the course

1. **LU factorization**
   Introduction. Gaussian elimination. LU factorization. Pivoting.
2. Existence and uniqueness of LU factorization. Symmetric positive definite matrices. Cholesky factorization. Band matrices.
3. **QR factorization**
   Orthogonal matrices. QR factorization. The Gram–Schmidt algorithm.
4. Givens rotation. Householder reflections.
5. **Iterative methods**
   Matrix and vector norms. Basic iterative schemes: Jacobi, Gauss–Seidel, simple iteration.
6. Necessary and sufficient conditions for convergence.
7. **Linear least squares**
   Normal equation. QR and least squares.
8. **Orthogonal polynomials**
   Orthogonal systems. Three–term recurrence relation.
9. **Polynomial interpolation**
   Lagrange formula. Divided differences. Newton formula.
10. **Error bounds for polynomial interpolation**
    Error bound for Lagrange interpolation. Chebyshev polynomials.
11. **Approximation of linear functionals**
    Numerical integration. Gaussian quadrature. Numerical differentiation.
12. The Peano kernel theorem and its application.

2. Lecture Notes on the Web

- I will try to put every handout on the web-site of the Numerical Analysis Group at `<www.damtp.cam.ac.uk/user/na/na.html>` a few days before the corresponding lecture.

3. Appropriate books

1. S. D. Conte, C. de Boor, Elementary numerical analysis, McGraw-Hill, New-York, 1980.
2. G. H. Golub, C. Van Loan, Matrix computation, Johns Hopkins University Press, 1996.
3. M. J. D. Powell, Approximation theory and methods, Cambridge University Press, 1981.

4. Communication

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