Mathematics 391 Numerical Analysis I

(see Course Descriptions for the applicable academic year: http://www.ucalgary.ca/pubs/calendar/)

Syllabus

Topics	**Number of Hours**
Iterative solution of non-linear equation in one variable	9
Solution of linear systems: direct elimination, matrix factorization, iterative methods, matrix norms, convergence	16
Iterative solution of non-linear systems by fixed point iteration and Newton's method	6
The symmetric eigenvalue problem, Gershgorin's Theorem, the power method	5
TOTAL HOURS	**36**

Software for carrying out computational experiments was available on the University's main-frame computer through the provision of a "laboratory" equipped with terminals.

Overview

This course is an introduction to the methods, tools and concepts of numerical analysis. It assumes knowledge of the standard introductory calculus sequence, matrix theory and some familiarity with procedural programming languages.

Course Outcomes

After successfully completing the course, students should be able to

1. Understand the principles of digital arithmetic and numerical approximations, including number representations, accuracy, stability, convergence and error propagation.
2. Identify stable and accurate algorithms that solve general nonlinear scalar equations. This includes their derivation, error analysis and limitations.
3. Understand the concept of polynomial interpolation, appreciate its role in the approximation of functions, numerical integration, and recognize its sensitivity to nodes location.
4. Derive the basic numerical integration methods both interpolatory and Gaussian, and

appraise their accuracy.

5. Describe and apply the basic methods for solving systems of linear equations, both direct, such as Gauss elimination and factorization, and iterative methods, such as Jacobi, Gauss-Seidel and Relaxation. This includes the ability to analyze the stability and conditioning of a linear system of equations.
6. Outline the basic Power and the QR methods for solving the algebraic eigenvalue problem, with emphasis on the symmetric case.
7. Demonstrate skills in basic programming of simple numerical algorithms.

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2001:08:21 Calendar Description change 2002:07:01
Prerequisite change: 2008:07:01
LPB:jml