ADVANCED NUMERICAL METHODS II
MATH/CS8510

Prerequisite: MATH1970, MATH3350

Hours Credit: 3 hours

Catalog Description:

Numerical solutions of partial differential equations. parabolic, hyperbolic and elliptic types are studied. Convergence and stability criterion are developed. The Crank-Nicolson equations, along with explicit and implicit methods of solution are studied.

Objectives:

The laws of nature are often described with partial differential equations. It is important for students in science, engineering, and mathematics to be familiar with the numerical solution of these equations. Emphasis is placed on the convergence and stability of the methods studied.

Topics:

1). Parabolic Partial Differential Equations
   a). Crank-Nicolson Equations
   b). Implicit and explicit finite difference equations.
   c). Handling boundary conditions
   d). matrix norms
   e). Stability and convergence of the finite difference equations

2). Hyperbolic Partial Differential Equations
   a). Characteristics
   b). Finite difference equations
   c). Pade difference approximations

3). Elliptic Partial Differential Equations
   a). finite difference equations
   b). curved boundary formulas
   c). Iterative methods of solutions for matrix equations

Methods of Instruction:

The course will be presented by lecture, class discussion and questions.

Evaluation and Grading:

Evaluation will be based on the results of written examinations some or all of which will be take home tests. In addition, computer algebra assignments may be given and constitute a portion of the students course grade.

Bibliography:

Text: Smith G. D., Numerical Solution of Partial differential Equations: Finite Difference Methods, 3d edition, Clarendon Press, Oxford 1992.

[1] Ames William F., Numerical Methods for Partial Differential Equations, 3d edition, Academic Press, 1992.

[2] Thomas J. W., Numerical Partial Differential Equations Conservation Laws and Elliptic Equations, Springer texts in applied mathematics.

[3] Johnson Claes, Numerical Solution of Partial Differential Equations by the Finite Element method, Cambrdge University Press.

[4] Evans Gwynne, Numerical Solution of Partial Differential Equations, Springer 1999.

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