Finite difference method and its application to solving some boundary value problems for the heat equation

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Abstract: The thesis focuses on studying the mathematical foundation of the finite difference method and its practical applications in solving boundary value problems for heat transfer partial differential equations. The content begins with an overview of the Matlab programming environment and graphics processing tools that support result visualization. The author delves into fundamental theory: definitions of difference grids, grid functions, Euler methods (implicit/explicit), and the Crank-Nicolson method. In particular, the thesis provides a detailed implementation of applying finite differences to solve the heat equation in one-dimensional, two-dimensional (steady state), and multi-dimensional spaces (alternating direction implicit method), while analyzing the stability and convergence of each model.

Keywords: Finite difference method, heat equation, Matlab, boundary value problem, differential equation