ABSTRACT

In this thesis two methods are developed, based on rational approximations to the matrix exponential function, for solving heat equation with variable coefficients. These methods are L-stable, third-order accurate in space and time, and do not require complex arithmetics. In the development of these methods second-order spatial derivatives are approximated by third-order difference approximations which gives a system of ordinary differential equations and that system is expressed in matrix-vector forms. Also the solutions of these systems satisfy recurrence relations that ultimately leads to the development of parallel algorithms. These algorithms are tested on heat equations with variable coefficients, subject to homogeneous and time-dependent boundary conditions, and no oscillations are observed in the results.