ABSTRACT

This thesis develops two families of numerical methods, based upon rational approximations to the matrix exponential function, for solving heat equation. These methods are L_0-stable, third- and fourth-order accurate in space and time, and pass up the complex arithmetics. In these methods second-order spatial derivatives are approximated by third and fourth-order difference approximations which produce system of ordinary differential equations expressible in matrix-vector forms. Solutions of these systems satisfy recurrence relations that leads to the development of parallel algorithms. Parallel algorithms are tested on heat equation, subject to time -dependent and homogeneous boundary conditions with constant coefficients. No oscillations are observed in the results.