

ABSTRACT

In this thesis method of lines is used for rational approximation to the matrix exponential function for solving first order hyperbolic partial differential equations with source terms. This method is L-stable, third-order accurate in space and time, and do not require complex arithmetics. In the development of this method first order spatial derivative is approximated by third order difference approximations which give a system of ordinary differential equations and that system is expressed in matrix vector form. Also the solution of these systems satisfies recurrence relation that ultimately leads to the developed of parallel algorithms. These algorithms are tested on hyperbolic equations with source terms subject to linear and nonlinear problems.