To be presented at SPIE Int. Symp. on Optical Science, Engineering, and Instrumentation: Mathematical Methods in Geophysical Imaging IV, 4-9 August 1996, Denver, Colorado

A Class of Unconditionally Stable Explicit Methods for Solution of Acoustic Wave Equations

Amir Fijany[1], Fred Aminzadeh[2], Joseph P. Stefani[3], and Paul C. Messina[4]

[1]*Jet Propulsion Laboratory, California Institute of Technology*
[2]*Unocal Corporation*
[3]*Chevron Petroleum Technology Company*
[4]*Center for Advanced Computing Research, California Institute of Technology*

ABSTRACT

In a recent paper we have presented the mathematical foundation of a class of novel, unconditionally stable, explicit methods for solution of the Acoustic Wave Equation. In this paper we present further analysis of these methods in terms of efficient inclusion of the absorbing boundary conditions and higher order spatial and temporal accuracy as well as their extension to three-dimensional problems. We also discuss the numerical properties of these methods by presenting the results of the practical implementation for two and three-dimensional problems on serial architectures. Efficient techniques for implementation of these methods on massively parallel MIMD architectures are also discussed. Specifically, the special structure of these methods is utilized to further improve computational efficiency for the cases wherein the velocity field is piecewise constant.

Key Words: *Seismic Modeling, Acoustic Wave Equations, Implicit and Explicit Methods, Massively Parallel Computation, MIMD Parallel Architectures*