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Improvements in efficiency for the boundary element method using domain decomposition with a far-field approximation.

A. Dobson (1) and E. Liu (2)

(1) University of Hamburg, Institut fuer Geophysik, Bundesstrasse 55, 20146 Hamburg (dobson@dkrz.de) (2) British Geological Survey, Murchison House, West Mains Road, Edinburgh

The boundary element method (BEM) is a method for generating synthetic seismograms and is less well known, perhaps, than finite difference, pseudo spectral or finite element methods. The indirect version of the method is based on finding solutions to a system of simultaneous equations. These equations describe the displacement field within an elastic medium via the use of a distribution of 'fictitious' or secondary sources which lie on the boundary of that medium.

The method is accurate for layered earth models for which the interfaces are highly heterogeneous and have high impedance contrasts. However, the main drawback of the BEM is that large matrices need to be inverted in order to solve the system of simultaneous equations. This can lead to excessive computation time and memory requirements.

One possible solution to the heavy computational demand of the BEM could be the use of domain decomposition. This is a method which splits the earth model up into a number of sub-domains. The matrix inversion for each of these sub-domains is much quicker than the inversion of the whole model. Connection between the sub-domains is maintained by 'propagating' the wavefield from one sub-domain to another. This is an iterative process where the number of required iterations depends on frequency, number of sub-domains and model properties. The propagation time can be kept to a minimum by using a far-field approximation.