Fast multipole boundary element method for elastic wave scattering in 2-D anisotropic solids

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Abstract

This paper presents a fast multipole boundary element method (FMBEM) for elastic wave scattering in 2-D anisotropic solids. The fundamental solutions, first proposed by Wang and Achenbach (1994), for 2-D general anisotropic elastodynamics include surface integration over the unit circle. They solved wave scattering problems by a cavity in frequency domain and the time-domain BEM using traction boundary integral equations has also been applied to dynamic crack analyses in anisotropic solids. In addition, elastic wave scattering in general anisotropic elastic solids has been analyzed by the convolution quadrature time-domain boundary element method (CQ-BEM). In general, the integration over the unit circle is numerically evaluated. However, numerical evaluation of the integration is time-consuming. Therefore, it is desirable to reduce the computational time required for elastodynamic BEM analysis of anisotropic solids. Therefore, in this research, a fast multipole boundary element method is applied to the BEM for 2-D anisotropic elastodynamics. The fast multipole method (FMM) has been developed as a technique to reduce the computational time and memory requirement for various large scale problems. In the conference presentation, the formulation of our proposed BEM for 2-D anisotropic solids is presented. Some numerical and parallel computing techniques are also discussed. As numerical examples, the problems of elastic wave scattering by cavities are solved to validate the proposed method.

Keywords: Boundary Element Method, Anisotropy, Fast Multipole Method, Wave Propagation