A frequency-domain boundary element method using Sinc approximation for SH wave scattering

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Abstract

This study presents a frequency-domain boundary element method (BEM) using Sinc approximation via double exponential transformation. The proposed method is applied to analyses of SH wave scattering in elastic solids.

BEM is well known as an effective approach for numerical analysis of wave scattering. This is because BEM requires boundary discretization only, and is able to treat infinite domain straightforwardly. Thus, BEM can produce accurate numerical solutions compared with other computational methods such as finite element method (FEM) and finite difference method (FDM), which require spatial discretization over the domain of interest.

In the conventional BEM, spatial discretization which evaluates boundary values and offers unknown coefficients has been performed by polynomial approximation. In this approximation, accurate numerical solutions can be obtained by increasing the order of the polynomial. However, the approximation using high-order polynomials complicates the treatment of the boundary integrals, especially, analytical treatment of singular integration.

On the other hand, Sinc approximation has been applied to Volterra and Fredholm integral equations of the second kind. The Sinc approximation offers a highly accurate approximation compared with the polynomial ones. Especially, Sinc approximation via double exponential transformation can remove analytical treatment of singular integration, and compute the value of the singular integration numerically.

In the presented formulation, a regularized boundary integral equation is utilized, and as numerical examples, SH wave scattering problems are solved. The results show the validity of our proposed BEM.

Keywords: **Boundary element method, Sinc approximation, Wave scattering**