

Modeling of Wave Propagation in Unbounded Domains Using the Scaled Boundary Finite Element Method

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In this paper the dynamic soil-structure interaction problem is modeled using a scaled boundary finite element method (SBFEM) in the time domain. The original SBFEM formulation assumes a piece-wise constant approximation of the acceleration unit-impulse response matrix within one time step. A small maximum step size is required to make the algorithm stable. In this paper, the procedure is formulated in terms of the displacement unit-impulse response matrix, which leads two essential improvements: (1) The displacement unit-impulse response matrix is calculated using a more accurate and efficient approach, based on a piece-wise linear approximation. (2) The soil-structure interaction force described by the convolution integral is only calculated before a truncation time, which reduces the computational effort. Derivations of the corresponding efficient schemes will be presented and verified using numerical examples.

Keywords: SBFEM, unbounded domain, displacement unit-impulse response, soil-structure interaction, convolution integral