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Dynamic Analysis of SSI systems via a Coupled Finite-element/Scaled Boundary Finite-element Model

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Abstract:

A coupled model based on finite element method (FEM) and scaled boundary FEM (SBFEM) for transient dynamic response of large-scale SSI systems is presented. The well-established FEM is used for modeling the near-field bounded domains. A local high-order transmitting boundary, which is based on SBFEM and the improved continued fraction solution for the dynamic stiffness matrix, is used for modeling the dynamic response of the far-field unbounded domains. The stability of the high-order boundary depends on the general eigenproblem of the coefficient matrices. Possible spurious modes can be eliminated using the spectral shifting technique. The bounded and unbounded formulations are coupled via the interaction force vector at the interface. The standard equations of the coupled model in the time domain are obtained by combining the dynamic equations of bounded and unbounded domains, which can be solved by standard time-stepping procedures. The validity of the coupled model is shown by means of three numerical examples.

Keywords: Dynamic soil-structure interaction, Coupled FEM-SBFEM model, High-order transmitting boundary, Spectral shifting technique