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Elastic wave propagation in multi-domain with a symetric BEM/FEM coupling

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Many applications involving elastic wave propagation in heterogeneous media have to deal simultaneously with domains with a size corresponding to several orders of magnitude of a characteristic wavelength and small domains of the order of this wavelength. More than often, the largest domain has to be truncated with implies the incorporation of the radiation conditions. For all those reasons, the computation may be costly.

Among the available numerical methods, Finite Elements Method (FEM) is particularly well suited for analyzing problems in complex environments with many heterogeneities. However, taking into account the radiation boundary condition can be challenging. Conversely, the Boundary Element Method (BEM) is adequate to deal with the latter drawback but is inadequate for very heterogeneous media. To overcome these drawbacks, FEM/BEM coupling strategies have been proposed [3, 1, 2].

Among the existing coupling approaches, Costabel [4] proposed an attractive method that preserves the symmetry of the stiffness matrix and involves a hypersingular boundary integral equation. In this contribution, we propose to extend this formulation to elastodynamics. The objective of this work is to demonstrate the actual efficiency of this approach in this context. Examples concerning seismic site effects will illustrate this. Indeed, the triggering of the earthquake and the wave propagation in the earth's crust will be done using the BEM, while the FEM will model the ground near the surface, including soft layers (sedimentary basins).

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