The Indirect Boundary Element Method (IBEM) for Seismic Response of Topographical Irregularities in Layered Media

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The seismic hazard assessment of spatially extended constructions, such as dams, bridges or pipelines, needs generally to simulate the ground motion response to specific seismic sources in a large volume. Several methods have been developed and the Finite Element Method (FEM) is generally preferred because of its facility of use. Nevertheless, the analysis of fault loading and stress concentrations induced by earthquakes requires fine meshes and the processing of high frequencies. Consequently it implies high computational costs.

The Indirect Boundary Element Method (IBEM) is another computational tool that can be employed. Here it is used to study the response of a site to historical seismic activity. This method is much more adapted to model wave propagation through wide areas and it is well suited to accurately represent the diffraction that can occur on a fault. This approach has mainly been applied to simple geometrical configurations. In this work the formulation is refined to simulate wave propagation in complex geometrical configurations such as a stratified media crossed by thin faults.

Two main developments are here compared; one integrates the Discrete Wave Number (DWN) method inside the IBEM in order to represent the stratified media with a low computational cost but assuming unbounded parallel flat layers. The other is the extension of IBEM to several media in contact. This latter method allows more versatility but has a higher computational cost compared to the method with DWN. The two developments are presented and their results compared for various configurations.