SH-wave Scattering at a Semi-Cylindrical Hill and a Semi-Cylindrical Alluvial Basin by Hybrid Method

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ABSTRACT

The response of surface motion inside and near an irregular area embedded into an elastic half-plane is investigated for the case of incident plane *SH* wave. The irregular areas include a semi-cylindrical hill and semi-cylindrical alluvial basin. The results of simple geometric shapes such as semi-circular or semi-elliptical canyons are obtained by using separation of variables and expansion of the solution in a basis of orthogonal functions. In this paper, based on a variational formalism which proposed by Mei(1980), a hybrid method which combing the finite element and series expansion method is implemented to solve the scattering problems. We define a substructure which enclosing the irregular area can easily be formulated by finite element method. The unknown boundary data called the scattered waves can be formulated through a series representation with unknown coefficients. Due to the continuity condition at the interface, therefore, the unknown coefficients of this series representation are treated as generalized coordinates and can be easily formulated by the same variational principle. The expansion function of the series representation is constituted of basis function, each basis function is constructed by Lamb's solution and satisfies both traction free condition at ground surface and radiation condition at infinity. The merit of the hybrid method is that the flexibility of finite elements offers the greatest advantage to model the irregular area. We use a simple mapping function to calculate the coordinates of the irregular region. The node numbers of the finite elements and the arrangement of the elements are the same as different areas.

Keywords: semi-cylindrical hill, semi-cylindrical alluvial basin, *SH* wave, scattering wave, hybrid method, mapping function