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Dynamic Response around Inclusions in Infinitely Inhomogeneous Media

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Abstract : The problem of elastic wave propagation in inhomogeneous medium has always been a classic problem. Due to the frequent occurrence of earthquakes, many economic losses and casualties have been caused, therefore, to prevent earthquake damage to people and reduce damage, this paper studies the dynamic response around the circular inclusion in the whole space with inhomogeneous modulus, the inhomogeneity of the medium is reflected in the shear modulus of the medium with the spatial position, and the density is constant, this method can be used to solve the problem of the underground buried pipeline. Stress concentration phenomena are common in aerospace and earthquake engineering, and the dynamic stress concentration factor (DSCF) is one of the main factors leading to material damage, one of the important applications of the theory of elastic dynamics is to determine the stress concentration in the body with discontinuities such as cracks, holes, and inclusions. At present, the methods include wave function expansion method, integral transformation method, integral equation method and so on. Based on the complex function method, the Helmholtz equation with variable coefficients is standardized by using conformal transformation method and wave function expansion method, the displacement and stress fields in the whole space with circular inclusions are solved in the complex coordinate system, the unknown coefficients are solved by using boundary conditions, by comparing with the existing results, the correctness of this method is verified, based on the superiority of the complex variable function theory to the conformal transformation, this method can be extended to study the inclusion problem of arbitrary shapes. By solving the dynamic stress concentration factor around the inclusions, the influence of the inhomogeneous parameters of the medium and the wavenumber ratio of the inclusions to the matrix on the dynamic stress concentration factor is analyzed. The research results can provide some reference value for the evaluation of nondestructive testing (NDT), oil exploration, seismic monitoring, and soil-structure interaction.

Keywords : circular inclusions, complex variable function, dynamic stress concentration factor (DSCF), inhomogeneous medium
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