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Surface Motion of Anisotropic Half Space Containing an Anisotropic Inclusion under SH Wave

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Abstract : Anisotropy is very common in underground media, such as rock, sand, and soil. Hence, the dynamic response of anisotropy medium under elastic waves is significantly different from the isotropic one. Moreover, underground heterogeneities and structures, such as pipelines, cylinders, or tunnels, are usually made by composite materials, leading to the anisotropy of these heterogeneities and structures. Both the anisotropy of the underground medium and the heterogeneities have an effect on the surface motion of the ground. Aiming at providing theoretical references for earthquake engineering and seismology, the surface motion of anisotropic half-space with a cylindrical anisotropic inclusion embedded under the SH wave is investigated in this work. Considering the anisotropy of the underground medium, the governing equation with three elastic parameters of SH wave propagation is introduced. Then, based on the complex function method and multipolar coordinates system, the governing equation in the complex plane is obtained. With the help of a pair of transformation, the governing equation is transformed into a standard form. By means of the same methods, the governing equation of SH wave propagation in the cylindrical inclusion with another three elastic parameters is normalized as well. Subsequently, the scattering wave in the half-space and the standing wave in the inclusion is deduced. Different incident wave angle and anisotropy are considered to obtain the reflected wave. Then the unknown coefficients in scattering wave and standing wave are solved by utilizing the continuous condition at the boundary of the inclusion. Through truncating finite terms of the scattering wave and standing wave, the equation of boundary conditions can be calculated by programs. After verifying the convergence and the precision of the calculation, the validity of the calculation is verified by degrading the model of the problem as well. Some parameters which influence the surface displacement of the half-space is considered: dimensionless wave number, dimensionless depth of the inclusion, anisotropic parameters, wave number ratio, shear modulus ratio. Finally, surface displacement amplitude of the half space with different parameters is calculated and discussed.

Keywords : anisotropy, complex function method, sh wave, surface displacement amplitude
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