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Rayleigh-type wave in a nonlocal elastic solid with voids

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Abstract

The present work is concerned with propagation of surface waves in an isotropic homogeneous nonlocal elastic solid half-space with voids. Dispersion relation for Rayleigh-type surface wave has been derived, which is found to be complex in nature. The variation of phase speed and corresponding attenuation of Rayleigh-type wave against frequency, nonlocality and void parameters is computed for a specific model and presented graphically. It is shown that only one mode of Rayleigh-type wave exists, which faces a critical frequency same as the critical frequency of shear wave. The dispersion arises due to the presence of voids and nonlocality in the medium. The particle motion is elliptical and a tilt in the plane of particle motion occurs due to the presence of void parameter 'τ' in the medium. In the low frequency range, the variation in ellipticity is due to the presence of voids in the medium. Some particular cases have been deduced from the present formulation.

Key words: Rayleigh wave; Nonlocality; Voids; Dispersion; Phase speed; Attenuation.

1 Introduction

Lord Rayleigh (1885) was the first, who showed that there can exist a type of wave that can travel near the boundary surface of an elastic solid half-space and penetrate very little into the medium. These waves are called Rayleigh waves in the literature. Rayleigh waves are found to be a combination of longitudinal and transverse motions and the particle motion is elliptically retrograde [see Love (1944)]. These waves have wide range of applications in seismology, acoustics, geophysics, telecommunications industry and materials science and several problems have been studied extensively since long. It would not be far-fetched to say that Rayleigh's study of