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Remarks on impact of irregularity on SH-type wave propagation in micropolar elastic composite structure

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Abstract

The present study investigates the propagation characteristics of SH-type wave and a new type of dispersive surface wave in an irregular composite structure comprised of a layer overlying a half-space, both constituted by distinct homogeneous micropolar isotropic elastic materials. At the common interface of the composite structure, two types of irregularities viz. rectangular and parabolic shaped, are studied in two distinct cases. Closed-form of frequency equations of SH-type wave associated with these cases have been obtained and matched with the classical Love wave equation in the isotropic case of the composite structure without irregularity at the common interface. Existence of new type of dispersive surface wave along with its dispersion relation has been deduced in the closed-form by adopting a distinct mathematical treatment for various cases concerned with the presence and absence of microrotational components in the composite structure. It is also examined that the dispersion equation of new type of dispersive surface wave vanishes identically in isotropic case of the composite structure. To unravel the effect of irregularity at the common interface and micropolarity associated with micropolar composite structure on SH-type and new type of dispersive surface wave, numerical computation and graphical demonstrations have been carried out in a comparative manner which serves as a salient feature of the study.

Keywords: micropolar elasticity, irregularity, perturbation technique, dispersion equation, SH-type wave.

1. Introduction

Classical continuum mechanics is based on the fundamental idea that the laws of motion and the axioms of constitution are valid for every part of the body irrespective of how small it is assumed. But the loss of accuracy in the theory may stem for granular or molecular structure of the body. Metal, polymers, composites, soils, rocks, concrete and other natural and synthetic materials including biological, engineering and geological media are comprised of microstructure. For the propagation of waves having high frequencies or short wave lengths, in particular,

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