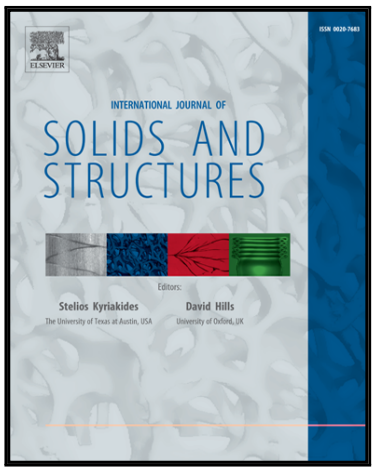

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Elastic wave propagation in simple-sheared hyperelastic materials with different constitutive models

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Abstract

We investigate the elastic wave propagation in various hyperelastic materials which are subjected to simple-shear deformation. Two compressible types of three conventional hyperelastic models are considered. We found pure elastic wave modes that can be obtained in compressible neo-Hookean materials constructed by adding a bulk strain energy term to the incompressible strain energy function. Meanwhile, for the compressible hyperelastic models which are reformulated into deviatoric and hydrostatic parts, only quasi modes can propagate, with abnormal ray directions that can be observed for longitudinal waves. Moreover, the influences of material constants, material compressibility and external deformations on the elastic wave propagation and refraction in these hyperelastic models are systematically studied. Numerical simulations are carried out to validate the theoretical results. This investigation may open a promising route for the realization of next generation metamaterials and novel wave manipulation devices.

Keyword: elastic wave; hyperelastic; stain energy function; compressible.

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