Elastic wave propagation in swelling porous medium

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Abstract

In the present work, the possibility of propagation of time harmonic waves in an infinite porous elastic medium within the context of isothermal linear theory of swelling porous elastic media given by Eringen [*Int. J. Engng. Sci.*, 32(1994), pp. 1337-1349] has been explored. It is found that five basic waves can travel at distinct speeds; three of them are longitudinal in nature and the remaining two are transverse in nature. All the waves are found to be dispersive and attenuating. The reflection phenomenon of an incident longitudinal wave from a stress free plane boundary of a porous elastic half space has been investigated for two types of boundary surfaces: (i) boundary having open-pores, and (ii) boundary having sealed-pores. Appropriate boundary conditions for these boundary surfaces are set up and the equations giving the reflection coefficients corresponding to various reflected waves are presented. Numerical computations are performed for a specific model consisting of sandstone, water and carbon-dioxide as solid, liquid and gas phases respectively of the porous medium. The variation of phase speeds and corresponding attenuation coefficients are depicted against frequency for all the possible waves. The nature of various reflection coefficients is found to be dependent on angles of incidence and their variation is depicted graphically. The energy balance law has been verified at the boundary surface at each angle of incidence. Comparison of the numerical results have been made with those obtained from Tuncay and Corapcioglu theory [*J. Appl. Mech.*, 64(1997), pp. 313-320] in the limiting case.