Abstract

The theory of Biot describing wave propagation in fluid saturated porous media is a good effective approximation of a wave induced in a fluid-filled deformable tube. Nonetheless, it has been found that Biot's theory has shortcomings in predicting the fast P-wave velocities and the amount of intrinsic attenuation. These problems arise when complex mechanical interactions of the solid phase and the fluid phase in the micro-scale are not taken into account. In contrast, the approach proposed by Bernabe does take into account micro-scopic interaction between phases and therefore poses an interesting alternative to Biot's theory. A wave propagating in a deformable tube saturated with a viscous fluid is a simplified model of a porous material, and therefore the study of this geometry is of great interest. By using this geometry, the results of analytical and numerical results have an easier interpretation and therefore can be compared straightforward. Using a Finite Difference viscoelastic wave propagation code, the transient response was simulated. The wave source was modified with different characteristic frequencies in order to gain information of the dispersion relation. It was found that the P-wave velocities of the simulations at sub-
critical frequencies closely match those of Bernabe's solution, but at over-critical frequencies they come closer to Biot's solution. (© 2013 Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim)

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