

Transient wave propagation in a one-dimensional partially saturated poroelastic column

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Abstract

Based on the effective stress principle in partially saturated media and average mixture theory, dynamic three phase model of partially saturated poroelasticity is established. This model is applied to a one-dimensional unsaturated poroelastic column and an analytical solution in the Laplace domain is obtained. By using the Convolution Quadrature Method of Lubich, the solution in the time domain is evaluated. Using some widely distributed materials as rock and soil, the wave propagation behavior in terms of displacement and pore-pressure are examined. By eliminating the viscosity of the fluid with assuming the fluid permeability to be infinity, the second and third compressional waves are identified.