ON THE WAVE PROPAGATION PROBLEM IN THE THEORY OF THERMOVISCOELASTIC MATERIALS WITH VOIDS

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ABSTRACT

In this paper we analyze the behavior of plane harmonic waves in a linear thermoviscoelastic material with voids. We take into account the effect of the thermoviscoelastic dissipation energy upon the corresponding wave solutions and, consequently, we study the damped in time wave solutions. There are five basic waves in an isotropic and homogeneous thermoviscoelastic space. Two of them are shear waves, while the remaining three are dilatational waves. The shear waves are uncoupled, damped in time with decay rate depending only on the viscosity coefficients. The three dilatational waves are coupled and consist of a predominantly dilatational damped wave of Kelvin-Voigt viscoelasticity, other is predominantly a wave carrying a change in the void volume fraction and the third takes the form of a standing thermal wave whose amplitude is decaying exponentially with time. The explicit form of the dispersion equation is obtained in terms of the wave speed and the thermoviscoelastic homogeneous profile. Furthermore, we use numerical methods and computations to solve the secular equation for some special materials.