

Modified multi-relaxation times of generalized thermoelasticity with higher order memory-dependent derivative: application to spherical cavity exposed to a harmonic varying heat

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Abstract: The objective of this work is to introduce different models of thermoelasticity theory. This study derives a new modified model of multi-relaxation time's generalized thermoelasticity based on the Taylor Series expansion of higher-order memory-dependent derivatives. The models of Green and Lindsay's two relaxation times and coupled thermoelasticity as well as memory-dependent derivatives with two relaxation times follow as limiting cases. Then the model is applied to investigate thermoelastic interactions in an infinite body with a spherical cavity whose boundary is subject to harmonic varying heat and traction-free. Laplace transforms were used to solve the basic governing equation problems. To find the analytical formulas of the physical quantities and to find inverse Laplace transforms, a numerical method was used. Detailed analysis of the effects of the memory response and the angular frequency of thermal vibration on the absolute temperature, stresses, and displacement is studied.

Key-words: Thermoelasticity, relaxation times, spherical cavity, higher order memory dependent derivatives