PREFACE

The term thermoelasticity involves a large category of phenomena. It comprises the general theory of heat conduction, thermal stresses, and strains set up by thermal flow in elastic bodies and the reverse result of temperature distribution caused by the elastic deformation itself. It is well known that the latter is an important cause of internal damping in elastic bodies. The domain of science dealing with the mutual interactions of deformation and temperature fields is called as thermoelasticity. Initially, the investigations in this area were based on the "uncoupled theory of thermoelasticity" with the simplifying assumption that the influence of the strain and stresses on the temperature field may be neglected. However, the absence of any elasticity term in the heat conduction equation for uncoupled thermoelasticity appears to be unrealistic. Moreover, the parabolic type of the heat conduction equation results in an infinite velocity of thermal wave propagation, which also contradicts the actual physical phenomena. Introducing the strain-rate term in the uncoupled heat conduction equation, Biot (1956) extended the analysis to incorporate the coupling effects of temperature and strain fields in theory of thermoelasticity. However, although the first shortcoming was eliminated in this theory, there remained the parabolic type partial differential equation of heat conduction, which leads to the paradox of infinite velocity of the thermal wave. To eliminate this paradox, generalized thermoelasticity theory was developed subsequently. During the last three decades, non-classical theories involving finite speed of heat transportation in elastic solids have been developed. The various non-Fourier heat conduction models have been introduced with the purpose to eliminate the inherent drawback in classical heat conduction theory and/or classical coupled thermoelasticity theory. Hence,

C_S Specific heat at zero stress

λ, μ Lame's elastic constants

α_t Coefficient of linear thermal expansion

C_{ijkl} Elasticity tensor

$\beta = (3\lambda + 2\mu)\alpha_t$ Thermoelasticity constant

τ_q Phase-lag of heat flux vector

τ_T Phase-lag of temperature gradient

τ_v Phase-lag of thermal displacement

δ_{ij} Kronecker delta

$\delta(.)$ Dirac delta function

∇ Gradient operator

$\nabla^2 = \Delta$ Laplacian operator

Throughout the thesis, the subscripted comma notations are used to represent the partial derivatives with respect to the space variables.

The over-headed dots denote partial derivatives with respect to time variable, t.

Subscripts i, j, k take the values 1, 2, 3 and summation is implied by index repetition.

LIST OF SYMBOLS

u_i	Components of displacement vector
e_{ij}	Components of strain tensor
$e_{ii} = e$	Dilatation
σ_{ij}	Components of stress tensor
q_i	Components of heat flux vector
θ	Temperature above the reference temperature
θ_0	Reference temperature
b_i	Components of the body force vector
h_i	Components of the body force per unit mass
r	External heat source
ϖ	Heat source per unit mass
ρ	Mass density of the material
S	Entropy per unit mass
S_0	Initial Entropy
k	Thermal conductivity of the material
k^*	Rate of thermal conductivity of the material
c_E	Specific heat at constant strain and volume

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