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ELASTODYNAMIC BEHAVIOUR OF GENERALIZED MICROSTRETCH THERMOELASTIC MASS DIFFUSION MEDIUM SUBJECTED TO MECHANICAL FORCES AND PULSED HEATING

ELASTODINAMIČKO PONAŠANJE GENERALISANE MIKROZATEZNE TERMOELASTIČNE DIFUZNE SREDINE OPTEREĆENE MEHANIČKIM SILAMA I IMPULSNOM ZAGREVANJU

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- microstretch-thermoelastic
- laser heat source
- normal mode analysis
- normal force

Abstract

This paper is concerned with elastodynamical interactions of ultra-laser heat source with homogeneous microstretch-thermoelastic mass diffusion medium. The medium is subjected to application of various sources. Normal mode analysis technique has been applied to the basis equations to solve the problem. Expressions have been obtained for normal and tangential stress, microstress, and temperature distribution. The numerically computed results are shown graphically. The analyses of various stress quantities have been studied in the given model. Some special cases are also deduced from the present investigation.

Ključne reči
- difuzija
- mikrozatezna termoelastičnost
- laserski izvor toplote
- analiza režima normalnog moda
- normalno opterećenje

Izvod

U radu su opisane elastodinamičke interakcije laserskog izvora toplote sa homogenom mikrozateznom termoelastičnom difuznom sredinom. Ova sredina je izložena raznim vrstama opterećenja. Za dobijanje rešenja, primenjena je metoda analize u režimu normalnog moda na osnovne jednačine. Dobijeni su izrazi za normalni i tangencijalni napon, mikronapon, kao i za raspodelu temperature. Rezultati dobijeni numeričkim računom su predstavljeni grafički. Pojedine vrednosti napona su analizirane u predstavljenom modelu. Izdvojeni su i izvesni specijalni slučajevi u predstavljenom istraživanju.

INTRODUCTION

Eringen /1/ developed the theory of thermo-microstretch elastic solids. Microstretch continuum is a model for Bravais lattice with basis on the atomic level and two-phase dipolar solids with a core on the macroscopic level. Composite materials reinforced with chopped elastic fibers, porous media whose pores are filled with gas or inviscid liquid, asphalt, or other elastic inclusions and solid-liquid crystals etc., are examples of microstretch solids. The concept of thermal relaxation is described by Ezzat et al. /2, 3/. Various problems in micropolar thermoelasticity and microstretch thermoelasticity are investigated by Marin /4, 5/.

Diffusion is defined as the spontaneous movement of the particles from a high concentration region to the low-concentration region, and it occurs in response to a concentration gradient expressed as the change in the concentration due to change in position. Thermal diffusion utilizes the transfer of heat across a thin liquid or gas to accomplish isotope separation. Simply, concentration is calculated using Fick's law. This law does not consider the mutual interaction between the introduced substance and the medium into which it is introduced, or the effect of temperature on these interactions. The thermodiffusion in elasticity is caused by coupling of temperature, mass diffusion, and that of strain in addition to heat and mass exchange with the environment. Nowacki /6-9/ developed the theory of thermoelastic diffusion by using coupled thermoelastic model. Dudziak and Kowalski /10/ and Olesiak and Pyryev /11/, respectively, discussed the theory of thermodiffusion and coupled quasi-stationary problems of thermal diffusion for an elastic layer.

Thermal shock due to exposure to an ultra-short laser pulse are interesting from the standpoint of thermoelasticity, since they require a coupled analysis of the temperature and deformation fields. A thermal shock induces very rapid movement in the structural elements, giving the rise to very significant inertial forces, and thereby, an increase in vibration. In irradiation of ultra-short pulsed laser, the high intensity energy flux and ultra-short duration lead to a very large thermal gradient. So, in these cases, Fourier law of heating is no longer valid. Scruby et al. /12/ and Rose /13/ have considered the point source model of lasers. Later, McDonald /14/ and Spicer /15/ proposed a new model known as laser-generated ultrasound model by introducing the thermal diffusion effect. Dubois /16/ experimentally demonstrated that penetration depth plays a very important role in the laser-ultrasound generation process. The thermoelastic response of laser in context of four theories is discussed by Youssef and Al-Bary, /17/. A problem for a thick plate under the effect of laser pulse thermal heating is studied by Elhagary, /18/. Kumar et al. /19/ studied the thermo-mechanical interactions of a laser pulse with microstretch thermoelastic medium.

This present research deals with disturbance in a homogeneous microstretch thermoelastic medium with mass diffusion due to the effect of ultra-laser heat source. The normal mode analysis technique is used to obtain the expressions for the displacement of components, the couple stress, temperature, mass concentration, and microstress distribution due to various sources.

BASIC EQUATIONS

Following Eringen /20/ and Al-Qahtani and Datta /21/, the basic equations for homogeneous microstretch thermoelastic mass diffusion medium in the absence of body force, body couple with laser heat source are given by:

Stress equation of motion:

$$(\lambda+\mu)\nabla(\nabla.\boldsymbol{u})+(\mu+K)\nabla^2\boldsymbol{u}+K\nabla\times\boldsymbol{\phi}+\lambda_0\nabla\phi^*- -\beta_1\left(1+\tau_1\frac{\partial}{\partial t}\right)\nabla T-\beta_2\left(1+\tau^1\frac{\partial}{\partial t}\right)\nabla C=\rho\ddot{\boldsymbol{u}}\,. \quad (1)$$

Couple stress equation of motion:

$$(\gamma\nabla^2-2K)\boldsymbol{\phi}+(\alpha+\beta)\nabla(\nabla.\boldsymbol{\phi})+K\nabla\times\boldsymbol{u}=\rho j\ddot{\boldsymbol{\phi}}\,. \quad (2)$$

Equation of balance of stress moments:

$$(\alpha_0\nabla^2-\lambda_1)\phi^*-\lambda_0\nabla.\boldsymbol{u}+v_1\left(1+\tau_1\frac{\partial}{\partial t}\right)T+v_2\left(1+\tau^1\frac{\partial}{\partial t}\right)C= =\frac{\rho j_0}{2}\ddot{\phi}^*. \quad (3)$$

Equation of heat conduction:

$$K^*\nabla^2T=\rho c^*\left(\frac{\partial}{\partial t}+\tau_0\frac{\partial^2}{\partial t^2}\right)T+\beta_1T_0\left(\frac{\partial}{\partial t}+\varepsilon\tau_0\frac{\partial^2}{\partial t^2}\right)(\nabla.\boldsymbol{u}-Q)+ +v_1T_0\left(\frac{\partial}{\partial t}+\varepsilon\tau_0\frac{\partial^2}{\partial t^2}\right)\phi^*+aT_0\left(\frac{\partial}{\partial t}+\gamma_1\frac{\partial^2}{\partial t^2}\right)C\,. \quad (4)$$

Equation of mass diffusion is:

$$D\beta_2\nabla^2(\nabla.\boldsymbol{u})+Da\left(1+\tau_1\frac{\partial}{\partial t}\right)\nabla^2T+\left(\frac{\partial}{\partial t}+\varepsilon\tau^0\frac{\partial^2}{\partial t^2}\right)C- -Db\left(1+\tau^1\frac{\partial}{\partial t}\right)\nabla^2C=0\,. \quad (5)$$

The constitutive relations are:

$$t_{ij}=(\lambda_0\phi^*+\lambda u_{r,r})\delta_{ij}+\mu(u_{i,j}+u_{j,i})+K(u_{j,i}-\varepsilon_{ijk}\phi_k)- -\beta_1\left(1+\tau_1\frac{\partial}{\partial t}\right)\delta_{ij}T-\beta_2\left(1+\tau^1\frac{\partial}{\partial t}\right)\delta_{ij}C\,, \quad (6)$$

$$m_{ij}=\alpha\phi_{r,r}\delta_{ij}+\beta\phi_{i,j}+\gamma\phi_{j,i}+b_0\varepsilon_{mji}\phi^*_{,m}\,, \quad (7)$$

$$\lambda_i^*=\alpha_0\phi^*_{,i}+b_0\varepsilon_{ijm}\phi_{j,m}\,. \quad (8)$$

The plate surface is illuminated by laser pulse given by the heat input

$$Q=I_0f(t)g(x_1)h(x_3)\,, \quad (9)$$

where: I_0 is the energy absorbed. The temporal profile $f(t)$ is represented as

$$f(t)=\frac{t}{t_0^2}e^{-\left(\frac{t}{t_0}\right)}. \quad (10)$$

Here, t_0 is the pulse rise time. The pulse is also assumed to have a Gaussian spatial profile in x_1

$$g(x_1)=\frac{1}{2\pi r^2}e^{-\left(\frac{x_1^2}{r^2}\right)}, \quad (11)$$

where: r is the beam radius; and as a function of the depth x_3, the heat deposition is due to the laser pulse, assumed to decay exponentially within the solid,

$$h(x_3)=\gamma^*e^{-\gamma^*x_3}\,. \quad (12)$$

Figures 1, 2 and 3 show the curve profiles of $f(t)$, $g(x_1)$, and $h(x_3)$, respectfully.

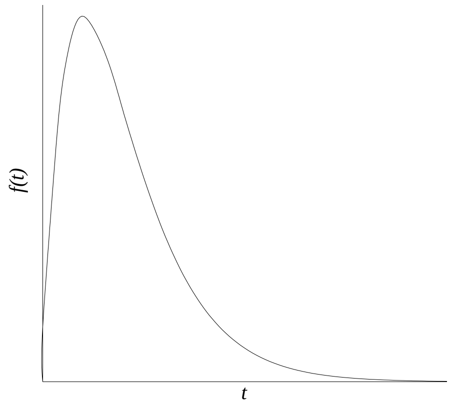

Figure 1. Temporal profile of $f(t)$.

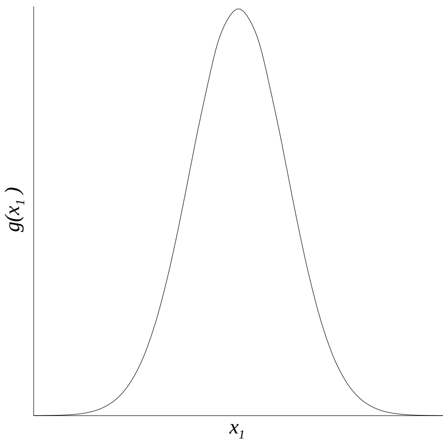

Figure 2. Profile of $g(x_1)$.

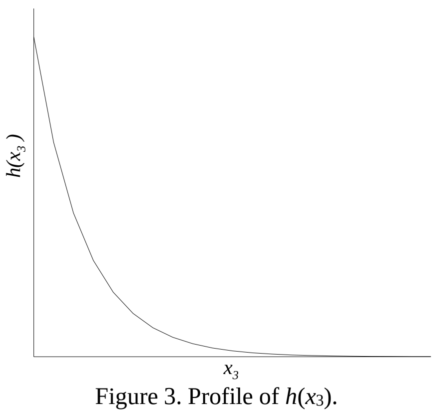

Figure 3. Profile of $h(x_3)$.

Equation (9) with the aid of Eqs.(10-11) and Eq.(12) takes the form:

$$Q=\frac{I_0\gamma^*}{2\pi r^2 t_0^2}\, t e^{-\left(\frac{t}{t_0}\right)} e^{-\left(\frac{x_1^2}{r^2}\right)} e^{-\gamma^* x_3}. \tag{13}$$

Here, the λ, μ, α, β, γ, K, λ_0, λ_1, α_0, b_0 are material constants, ρ is mass density, $\boldsymbol{u} = (u_1, u_2, u_3)$ is the displacement vector, and $\boldsymbol{\phi} = (\phi_1, \phi_2, \phi_3)$ is the microrotation vector, ϕ^* is the scalar microstretch function, T is temperature, and T_0 is the reference temperature of the body chosen, C is the concentration of the diffusion material in the elastic body, K^* is the coefficient of thermal conductivity, c^* is specific heat at constant strain, D is the thermoelastic diffusion constant, a is the coefficient describing the measure of thermal diffusion, and b is the coefficient describing the measure of mass diffusion effects, j is the microinertia, $\beta_1 = (3\lambda + 2\mu + K)\alpha_{t1}$, $\beta_2 = (3\lambda + 2\mu + K)\alpha_{c1}$, $v_1 = (3\lambda + 2\mu + K)\alpha_{t2}$, $v_2 = (3\lambda + 2\mu + K)\alpha_{c1}$, α_{t1}, α_{t2} are coefficients of linear thermal expansion, and α_{c1}, α_{c2} are coefficients of linear diffusion expansion, j_0 is the microinertia for the microelements, t_{ij} are components of stress, m_{ij} are components of couple stress, λ_i^* is the microstress tensor, e_{ij} are components of strain, e_{kk} is the dilatation, δ_{ij} is Kronecker delta function, τ^0, τ^1 are the diffusion relaxation times, and τ_0, τ_1 are thermal relaxation times, with $\tau_0 \geq \tau_1 \geq 0$.

In the above equations the symbol ‘,’ followed by a suffix denotes differentiation with respect to spatial coordinates and a superposed dot ‘ ˙ ’ denotes the derivative with respect to time, respectively.

FORMULATION OF THE PROBLEM

We consider a microstretch thermoelastic mass diffusion medium with rectangular Cartesian coordinate system $0x_1x_2x_3$ with x_3-axis pointing vertically downward the medium.

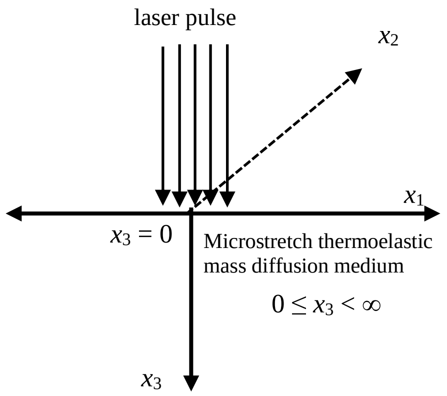

Figure 4. Geometry of the problem.

For two-dimensional problems, we take the displacement vector and microrotation vector as:

$$\boldsymbol{u}=(u_1,0,u_3)\,,\quad \boldsymbol{\phi}=(0,\phi_2,0)\,. \tag{14}$$

For further consideration it is convenient to introduce in Eqs.(1)-(5) the dimensionless quantities defined by:

$$u_i'=\frac{\rho\omega^* c_1}{\beta_1 T_0}u_i\,,\; x_i'=\frac{\omega^*}{c_1}x_i\,,\; t'=\omega^* t\,,\; T'=\frac{T}{T_0}\,,\; \tau_1'=\omega^*\tau_1\,,$$

$$\tau_0'=\omega^*\tau_0\,,\; \gamma_1'=\omega^*\gamma_1\,,\; t_{ij}'=\frac{1}{\beta_1 T_0}t_{ij}\,,\; \omega^*=\frac{\rho c^* c_1^2}{K^*}\,,$$

$$\phi_i'=\frac{\rho c_1^2}{\beta_1 T_0}\phi_i\,,\; \tau^{1\prime}=\omega^*\tau^1\,,\; c_1^2=\frac{\lambda+2\mu+k}{\rho}\,,\; c_2^2=\frac{\mu+k}{\rho}\,,$$

$$c_3^2=\frac{\gamma}{\rho j}\,,\; c_4^2=\frac{2\alpha_0}{\rho j_0}\,,\; \varepsilon\,\frac{\gamma^2 T_0}{\rho^2 c^* c_1}\,,\; m_{ij}^*=\frac{\omega^*}{c\beta_1 T_0}m_{ij}\,,$$

$$C'=\frac{\beta_2}{\rho c_1^2}C\,,\; Q=\frac{K^*\omega^{*2}}{C^*}Q'\,,\; \phi^{*\prime}=\frac{\rho c_1^2}{\beta_1 T_0}\phi^*\,. \tag{15}$$

According to Helmholtz, the representation of a vector into scalar and vector potentials, the displacement components u_1 and u_3 are related to non-dimensional potential functions ϕ and ψ as:

$$u_1=\frac{\partial\phi}{\partial x_1}-\frac{\partial\psi}{\partial x_3}\,,\quad u_3=\frac{\partial\phi}{\partial x_3}-\frac{\partial\psi}{\partial x_1}\,. \tag{16}$$

Substituting the values of u_1 and u_3 from Eq.(16) in Eqs.(1)-(5) and with the aid of Eqs.(14) and (15), after suppressing the primes, we obtain:

$$\nabla^2\phi-\ddot{\phi}+a_4\phi^*-\left(1+\tau_1\frac{\partial}{\partial t}\right)T-a_5\left(1+\tau^1\frac{\partial}{\partial t}\right)C=0\,, \tag{17}$$

$$\left(\nabla^2-a_8-a_{12}\frac{\partial^2}{\partial t^2}\right)\phi^*-a_9\nabla^2\phi+a_{10}\left(1+\tau_1\frac{\partial}{\partial t}\right)T+$$
$$+a_{11}\left(1+\tau^1\frac{\partial}{\partial t}\right)C=0\,, \tag{18}$$

$$\left(\frac{\partial}{\partial t}+\tau_0\frac{\partial^2}{\partial t^2}-\nabla^2\right)T+\left(1+\varepsilon\tau_0\frac{\partial}{\partial t}\right)\left(a_{13}\nabla^2\phi+\dot{a}_{14}\phi^*\right)+$$
$$+a_{15}\left(1+\gamma_1\frac{\partial}{\partial t}\right)\dot{C}=Q_0 f^*(x_1,t)e^{-\gamma^* x_3}\,, \tag{19}$$

$$\nabla^4\phi+a_{16}\left(1+\tau_1\frac{\partial}{\partial t}\right)\nabla^2 T+a_{17}\left(\frac{\partial}{\partial t}+\varepsilon\tau^0\frac{\partial^2}{\partial t^2}\right)C-$$
$$-a_{18}\left(1+\tau^1\frac{\partial}{\partial t}\right)\nabla^2 C=0\,, \tag{20}$$

$$a_2\nabla^2\psi-\ddot{\psi}+a_3\phi_2=0\,, \tag{21}$$

$$\nabla^2\phi_2-2a_6\phi_2-a_6\nabla^2\psi=a_7\ddot{\phi}_2\,. \tag{22}$$

Here, $\nabla^2=\frac{\partial^2}{\partial x_1^2}+\frac{\partial^2}{\partial x_3^2}$ is the Laplacian operator, $f(x_1, t) = \left[t+\varepsilon\tau_0\left(1-\frac{t}{t_0}\right)\right]e^{-\left(\frac{x_1^2}{r^2}+\frac{t}{t_0}\right)}$, and $Q_0=\frac{Q_{20}I_0\gamma^*}{2\pi r^2 t_0^2}$.

SOLUTION OF THE PROBLEM

The solution of the considered physical variables can be decomposed in terms of the normal modes as in the following form:

$$\{\phi,\psi,T,\phi_2,\phi^*,C\}(x_1,x_3,t)=\{\bar{\phi},\bar{\psi},\bar{T},\bar{\phi}_2,\bar{\phi}^*,\bar{C}\}(x_3)e^{i(kx_1-\omega t)}\,. \tag{23}$$

Here, ω is the angular frequency, and k is wave number.

Making use of Eq.(23), Eqs.(17)-(22), after some simplifications yield:

$$[A\boldsymbol{D}^8 + B\boldsymbol{D}^6 + C\boldsymbol{D}^4 + E\boldsymbol{D}^2 + F]\bar{\phi} = f_1(\gamma^*, x_1, t)e^{-\gamma^* x_3}, \quad (24)$$

$$[A\boldsymbol{D}^8 + B\boldsymbol{D}^6 + C\boldsymbol{D}^4 + E\boldsymbol{D}^2 + F]\bar{\phi}^* = f_2(\gamma^*, x_1, t)e^{-\gamma^* x_3}, \quad (25)$$

$$[A\boldsymbol{D}^8 + B\boldsymbol{D}^6 + C\boldsymbol{D}^4 + E\boldsymbol{D}^2 + F]\bar{T} = f_3(\gamma^*, x_1, t)e^{-\gamma^* x_3}, \quad (26)$$

$$[A\boldsymbol{D}^8 + B\boldsymbol{D}^6 + C\boldsymbol{D}^4 + E\boldsymbol{D}^2 + F]\bar{C} = f_4(\gamma^*, x_1, t)e^{-\gamma^* x_3}, \quad (27)$$

$$[\boldsymbol{D}^4 + G\boldsymbol{D}^2 + H]\bar{\psi} = 0. \quad (28)$$

where: $\boldsymbol{D} = d/dx_3$; $A = a_{21} - a_{33}$, $B = a_{37} - 2k^2a_{21} - a_{31}a_{39} - a_{34}$; $C = a_{38} + a_{21}k^4 - 2k^2a_{37} - a_{32}a_{39} - a_{31}a_{40} + a_{33}a_{43} + a_{34}a_{42}$, $H = -(k^2a_3a_6 + a_{35}a_{36})/a_2$; $E = a_{37}k^4 - 2k^2a_{38} - a_{32}a_{40} - a_{31}a_{41}$, $F = a_{38}k^4 - a_{32}a_{41} + a_{34}a_{44}$; $G = a_{35} + a_3a_6 - a_2a_{36}/a_2$. Also, a_i, $i = 19, \ldots, 44$.

The solution of the above system of Eqs.(24)-(28) satisfying the radiation conditions that $(\bar{\phi}, \bar{\psi}, \bar{T}, \bar{\phi}_2, \bar{C}) \to 0$ as $x_3 \to \infty$ are given as following:

$$\bar{\phi} = \sum_{i=1}^{4} c_i e^{-m_i x_3} + \frac{f_1}{f_5} e^{-\gamma^* x_3}, \quad (29)$$

$$\bar{\phi}^* = \sum_{i=1}^{4} \alpha_{1i} c_i e^{-m_i x_3} + \frac{f_2}{f_5} e^{-\gamma^* x_3}, \quad (30)$$

$$\bar{T} = \sum_{i=1}^{4} \alpha_{2i} c_i e^{-m_i x_3} + \frac{f_3}{f_5} e^{-\gamma^* x_3}, \quad (31)$$

$$\bar{C} = \sum_{i=1}^{4} \alpha_{3i} c_i e^{-m_i x_3} + \frac{f_4}{f_5} e^{-\gamma^* x_3}, \quad (32)$$

$$(\bar{\psi}, \bar{\phi}_2) = \sum_{i=5}^{6} (1, \delta_i) c_i e^{-m_i x_3}, \quad (33)$$

where: m_i^2 ($i = 1, 2, 3, 4$) are the roots of Eq.(24); and m_i^2 ($i = 5, 6$) are the roots of characteristic equation of Eq.(28), and $\alpha_{1i} = -\Delta_{2i}/\Delta_{1i}$, $\alpha_{2i} = \Delta_{3i}/\Delta_{1i}$, $\alpha_{3i} = -\Delta_{4i}/\Delta_{1i}$, $i = 1, 2, 3, 4$, and $\delta_i = a_3/(a_2m_i^2 + a_{35})$, $i = 5, 6$.

Here, Δ_{1i}, Δ_{2i}, Δ_{3i}, Δ_{4i}.

Substituting the values of $\bar{\phi}, \bar{\phi}^*, \bar{T}, \bar{\psi}, \bar{\phi}_2, \bar{C}$ from the Eqs. (29)-(33) in Eqs.(6)-(8) and using Eqs.(14)-(16) and Eq. (23), and then solving the resulting equations, we obtain:

$$\bar{t}_{33} = \sum_{i=1}^{6} G_{1i} e^{-m_i x_3} - M_1 e^{-\gamma^* x_3}, \quad (34)$$

$$\bar{t}_{31} = \sum_{i=1}^{6} G_{2i} e^{-m_i x_3} - M_2 e^{-\gamma^* x_3}, \quad (35)$$

$$\bar{m}_{32} = \sum_{i=1}^{6} G_{3i} e^{-m_i x_3} - M_3 e^{-\gamma^* x_3}, \quad (36)$$

$$\bar{\lambda}_3^* = \sum_{i=1}^{6} G_{4i} e^{-m_i x_3} - M_4 e^{-\gamma^* x_3}, \quad (37)$$

$$\bar{T} = \sum_{i=1}^{6} G_{5i} e^{-m_i x_3} - M_5 e^{-\gamma^* x_3}, \quad (38)$$

$$\bar{C} = \sum_{i=1}^{5} G_{6i} e^{-m_i x_3} - M_6 e^{-\gamma^* x_3}, \quad (39)$$

where: $G_{mi} = g_{mi}C_i$, $i, m = 1, 2, \ldots, 6$; G_{rs}, ($r, s = 1, 2, \ldots, 6$), M_r, ($r = 1, 2, \ldots, 6$).

Boundary conditions

We consider that the normal force and thermal and mass concentration sources are acting at the surface $x_3 = 0$ along with vanishing of couple stress in addition to thermal and mass concentration boundaries, considered at $x_3 = 0$ and $I_0 = 0$. Mathematically this can be written as:

$$t_{33} = -F_1 e^{i(kx_1 - \omega t)}, \ t_{31} = 0, \ m_{32} = 0, \ \lambda_3^* = 0,$$

$$\frac{\partial T}{\partial x_3} = F_2 e^{i(kx_1 - \omega t)}, \ \frac{\partial C}{\partial x_3} = F_3 e^{i(kx_1 - \omega t)}, \quad (40)$$

where: F_1 and F_2 are the magnitude of the applied force.

Substituting the expression of the variables considered into these boundary conditions, we can obtain the following system of equations:

$$\sum_{i=1}^{6} (G_{1i}, G_{2i}, G_{3i}, G_{4i}, m_i G_{5i}, m_i G_{6i}) c_i = \\ = (-F_1, 0, 0, 0, -F_2, -F_3). \quad (41)$$

The system of Eqs.(41) is solved by using the matrix method as follows:

$$\begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \\ c_5 \\ c_6 \end{bmatrix} = \begin{bmatrix} g_{11} & g_{12} & g_{13} & g_{14} & g_{15} & g_{16} \\ g_{21} & g_{22} & g_{23} & g_{24} & g_{25} & g_{26} \\ g_{31} & g_{32} & g_{33} & g_{34} & g_{35} & g_{36} \\ g_{41} & g_{42} & g_{43} & g_{44} & g_{45} & g_{46} \\ m_1g_{51} & m_2g_{52} & m_3g_{53} & m_4g_{54} & m_5g_{55} & m_6g_{56} \\ m_1g_{61} & m_2g_{62} & m_3g_{63} & m_4g_{64} & m_5g_{65} & m_6g_{66} \end{bmatrix} \begin{bmatrix} -F_1 \\ 0 \\ 0 \\ 0 \\ -F_2 \\ -F_3 \end{bmatrix} \quad (42)$$

SPECIAL CASES

(a) Microstretch thermoelastic solid

If we neglect the diffusion effect in Eq.(41), we obtain the corresponding expressions of stresses, displacements, and temperature for the microstretch thermoelastic solid.

(b) Micropolar thermoelastic diffusive solid

If we neglect the microstretch effect in Eq.(41), we obtain the corresponding expressions of stresses, displacements and temperature for the micropolar thermoelastic diffusive solid.

Variation of temperature with respect to time is depicted in Fig. 5.

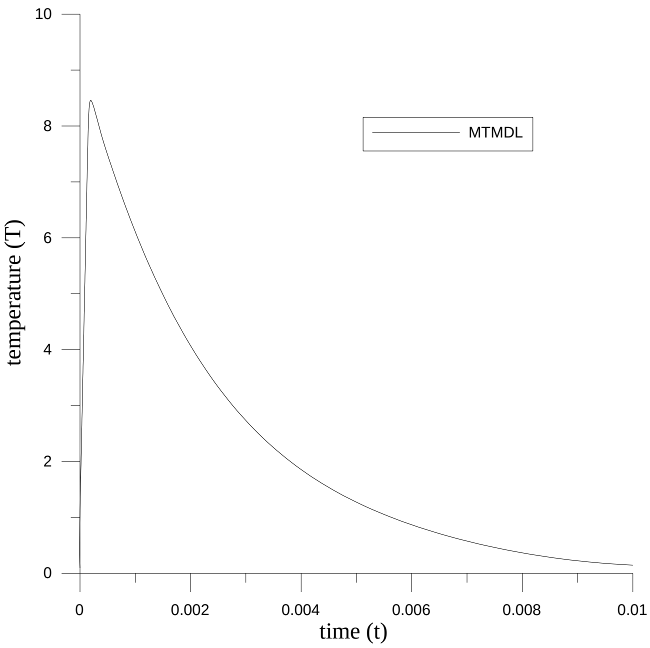

Figure 5. Variation of temperature w.r.t. time.

CONCLUSIONS

The problem consists of investigating displacement components, scalar microstretch, temperature distribution and stress components in a microstretch thermoelastic mass diffusion medium subjected to input laser heat source. Normal mode analysis is employed to express the results.

– It is noticed that the laser heat source has no significant role on mass concentration.
– The trend of variation of the physical quantities show similarity with Elhagary /18/, although diffusion effect is included.

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