ON SOME NONLINEAR AND NONCLASSICAL EQUATIONS OF HEAT DIFFUSION

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ANNOTATION

In this article, some non-linear and non-classical equations representing the heat dissipation process are shown.

Keywords. Heat, equation, function, derivative, stress deformation, temperature, vibration, coefficient , bending, expansion, differential equation.

INTRODUCTION

The component of many engineering structures consists of a stem and a plate, and the mathematical model of dynamic problems related to them is represented by mathematical physics equations. The equation of heat dissipation in the stern is one of them [1,2]. The classical solution of these equations is well-studied linearly, but the generalized solution for this linear and nonlinear heat-diffusion equation is not well-studied.

If the unknown function and its specific derivatives are involved in the equation representing the process of heat dissipation, such equations are called nonlinear heat dissipation equations.

For example heat spreading of Eq without a line in case common appearance

$Lu=\frac{\partial u}{\partial t}-a^2\sum_{i=1}^{n}\frac{\partial^2 u}{\partial x_i^2}+F(t,x_1,...,x_{n,}u,\frac{\partial u}{\partial x_1},...)=\frac{\partial u}{\partial t}-a^2\Delta u+F(t,x,u,\frac{\partial u}{\partial x},...)=0$ without to be can _ This problem is for n=1 as follows is written :

$$Lu\equiv u_t-a^2u_{xx}+F(t,x,u,u_x,...)=0$$

Without a line limits most of the time heat spread process without a line in the environment when it's late appear will be [3-4]. Examples we bring

1) If heat one sexual in the environment spreading heat _ _ _ _ spread coefficient u of level as follows dependent _ _ if _ _ $k=k_0u^\sigma$ heat spread equation [3]

$$u_t-a^2\frac{\partial}{\partial x}\left(u^\sigma\frac{\partial u}{\partial x}\right)=0 \text{ or } u_t-a^2\left[u^\sigma\frac{\partial^2 u}{\partial x^2}+\sigma u^{\sigma-1}\left(\frac{\partial u}{\partial x}\right)^2\right]=0$$

that 's it on the ground $a^2=\frac{k_0}{\rho c}$.

2) If $k=k_0K(u)$ if , then $u_t-a^2\frac{\partial}{\partial x}\left(K(u)\frac{\partial u}{\partial x}\right)=0$ or $u_t-a^2\left[K(u)\frac{\partial^2 u}{\partial x^2}+K'(u)\left(\frac{\partial u}{\partial x}\right)^2\right]=0$ will be

Many scientific books and in articles Sterjen , plate such as bodies vibration process the temperature effect with together is studied [4-7]. Such issues do not vibrate action expressive private derivative differential equations and heat spread equation with together is studied . In this

3) Tension with deformation between relationship

$$\sigma_x = E(\varepsilon_x - \alpha_T T) \quad (1)$$

appearance , deformation with the stern bending between geometric to connect as follows we can

$$\varepsilon_x = -z\frac{\partial^2(u-u_0)}{\partial x^2}, \qquad (2)$$

this on the ground $u = u(x,t)$- the stern bend _ z- Stergen cross in the section from the point neutral until the arrow was distance ; T - temperature ; α_T - from heat linear expansion coefficient [5,7].

(1) and (2) . the following to Eq let's put

$$m_c\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 M_x}{\partial x^2} + q, \qquad M_x = \iint_F z\sigma_x dF ,$$

The result the following equation harvest will be

$$EJ\frac{\partial^4(u-u_0)}{\partial x^4} + m_c\frac{\partial^2 u}{\partial t^2} = q - E\alpha_T\frac{\partial^2}{\partial x^2}M_\theta; \quad (3)$$

this on the ground EJ- the stern in bending singleness ; m_c- the stern unity to the length suitable coming mass _$M_\theta = \iint_F z\Theta dF$; $\Theta = T - T_0$, T_0- start absolute temperature ; q- addition static voltage ; F- Stergen cross section surface ;

Equation (3). the following heat spread equation deformation with dependence equation with together is considered .

$$\frac{\partial\Theta}{\partial t} = a_T\left(\frac{\partial^2\Theta}{\partial x^2} + \frac{\partial^2\Theta}{\partial y^2} + \frac{\partial^2\Theta}{\partial z^2}\right) - \frac{E\alpha_T T_0}{(1-2\nu)C_T}\frac{\partial}{\partial t}e,$$

here $a_T = \frac{\lambda_T}{C_T}$is the coefficient of temperature conductivity; λ_T- heat transfer coefficient; C_T- specific heat capacity in the absence of deformation; $e = \varepsilon_x + \varepsilon_y + \varepsilon_z$- volume expansion.

Size expansion Stergen bending and temperature with as follows is represented by [5,7]

$$e = -(1-2\nu)z\frac{\partial^2(u-u_0)}{\partial x^2} - 2(1+\nu)\alpha_T\Theta.$$

Apparently as it is on the ground harvest done heat spread equation classic heat spread from Eq different _

Above cause issued heat spread in Eqs heat spread inertia account if we get it , again one non-classical heat spread equation harvest we do

$$\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} + \frac{\partial^2 T}{\partial z^2} = \frac{1}{a_T}\frac{\partial T}{\partial t} + \frac{1}{c_q^2}\frac{\partial^2 T}{\partial t^2} + \frac{E\alpha_T T_0}{(1-2\nu)\lambda_T}e$$

$c_q = \sqrt{\frac{a_T}{\tau_r}}$ - heat spread speed , τ_r- hot flow relaxation time (metals for $\tau_r \approx 10^{-11}$ сек). $\frac{\partial^2 T}{\partial t^2}$- heat of flow inertia represents _ Heat spread in Eq this condition account get the idea the first times A. V. Lykov by offer done [4].

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