RECOGNITION OF CHARACTERISTICS OF NON-LINEAR THERMAL SOURCES USING TRANSITION WAVES

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We consider that the process of thermal wave propagation in the Earth may be described by following evolutional equation:

$$\partial u/\partial t = \Delta u + f(u), \ (1)$$

where $\Delta u = \partial^2 u/\partial x^2 + \partial^2 u/\partial y^2 + \partial^2 u/\partial z^2$ is Laplace operator (linear component), $f(u)$ is the non-linear function of thermal field. At the same time we can assume that $f(u) = \alpha\, u + \epsilon g(u)$, where $\alpha = const$, $\epsilon > 0$ is the some small parameter, $g(u)$ is the some non-linear function describing variations of the studied thermal field. Function $g(u)$ may be presented both as (a) conventional deterministic function and (b) random distribution function. We analyzed various presentations of $g(u)$ (by $\epsilon \neq 0$), for instance, $g(u) = u^3$. For the last case we consider the analytical expressions for the transitive solution of (1): $u(t, x, y, z) = \psi(x + y + z + vt)$, where v is the velocity of the traveling wave assigned as a parameter. Using a set of solutions of the last equation, we can reduce (1) to ordinary differential equation: $v\psi'(s) = \psi''(s) + \alpha\psi(s) + \epsilon\psi^3(s)$, where $s = x + y + z$. The obtained results allow to realize a control of diffusion processes by artificial introducing non-linear diffusion to the process under study.