Mathematical modeling of nonlinear problem biological population in not divergent form with absorption, and variable density

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Abstract: Consider the following Cauchy problem for degenerate parabolic equation in not divergence form with absorption and variable density

$$(1)\qquad \begin{array}{l} \frac{\partial u}{\partial t} = u^n \nabla \left(|x|^l u^{m-1} \left| \nabla u^k \right|^{p-2} \nabla u \right) + \gamma(t) u - b(t) u^q, \\ u(0,x) = u_0(x) \geq 0, x \in R^n \end{array}$$

Here $u(t,x)$ - the population, numbers n, l, k, p are the given numerical parameters characterizing media, $.0 < \gamma(t), b(t) \in C(0,\infty), q \geq 1$.

The problem (1) in particular value of numerical parameters used for modeling different physical, chemical, biological and other processes [1-4]. To investigating different qualitative properties of the solutions of the problem Cauchy (1) and boundary value problem for particular value of numerical parameters devoted many works. For instance, in the case $l = n = 0, m = k, 0 < q < 1, \gamma(t) = 0$ by analyzing an exact solution [2] establish the following properties of solutions: an inertial effect of a finite velocity of propagation of thermal disturbances, spatial heat localization and finite time localization solution effect. The problem (1) when $l = n = 0, m = k = 1, q \geq 1, \gamma(t) = b(t) = const$

is well-known equation of biological population studied in [4]

In this work it is find exact solution and based it the following properties an effect of a finite velocity population flash disturbances, spatial localization population flash established. It is obtained estimate of weak solution and free boundary, the condition of Fujita type global solvability considered problem proved. The results of the numerical experience discussed.

Keywords: Mathematical modeling, nonlinear problem, biological population, not divergent, absorption, variable density.

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