

Improving a method of constructing finite time blow-up solutions and its an application

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Abstract

We in this paper improve a method of establishing the existence of finite time blow-up solutions, and then apply it to study the finite time blow-up, the blow-up time and the blow-up rate of the weak solutions on the initial boundary problem of $u_t - \Delta u = |u|^{p-1}u$. By applying this improved method, we prove that $I(u_0) < 0$ is a sufficient condition of the existence of the finite time blow-up solutions and $\frac{2(p-1)}{p-2} \|u_0\|_{H^1}^2 \{(p-1) \|\nabla u_0\|_{L^2}^2 - 2(p+1)J(u_0)\}$ is an upper bound for the blow-up time, which generalize the blow-up results of the predecessors in the sense of the variation. Moreover, we estimate the upper blow-up rate of the blow-up solutions, too.

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