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Blow-up phenomena for some nonlinear parabolic problems under Robin boundary conditions☆

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ABSTRACT

This paper deals with the blow-up phenomena of the solutions to some nonlinear parabolic equation under Robin boundary conditions. Lower bounds for blow-up time are determined if the solutions blow up.

1. Introduction

In 2008, Payne et al. in their paper [1] considered the blow-up of solutions of equations of the form

$$u_t = \operatorname{div}(\rho(|\nabla u|^2)\operatorname{grad} u) + f(u) \tag{1.1}$$

with homogeneous Dirichlet boundary conditions. To get the lower bound for the blow-up time, the authors assumed that ρ is a positive $\mathcal{C}^1$ function which satisfies

$$\rho(s) + s\rho'(s) > 0, \quad s > 0. \tag{1.2}$$

The lower bound for the blow-up time of solution to Eq. (1.1) with Robin boundary conditions was obtained in paper [2], where ρ also satisfies the condition (1.2). The purpose of this paper is to investigate the question of blow-up for the solution of the problem

$$\begin{aligned} &u_t = [(|\nabla u|^p + 1)u_{,i}]_{,i} + f(u) \quad \text{in } \Omega \times (0, t^*), \\ &\frac{\partial u}{\partial \nu} + ku = 0 \quad \text{on } \partial\Omega \times (0, t^*), \\ &u(x, 0) = g(x) \geq 0 \quad \text{in } \Omega, \end{aligned} \tag{1.3}$$

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