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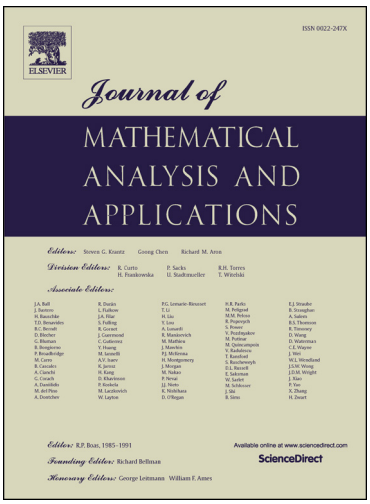

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Bounded solutions to a singular parabolic system

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Abstract

In this paper, we are concerned with the singular parabolic system $u_t = \Delta u + f(x)v^{-p}, v_t = \Delta v + g(x)u^{-q}$ in a smooth bounded domain $\Omega \subset \mathbf{R}^N$ subject to zero Dirichlet conditions, with initial conditions $u_0(x), v_0(x) > 0$. This problem is of interest as it is related to some problems in biology and physics. Under suitable assumptions on p, q and $f(x), g(x)$, some existence results of weak and classical solutions are obtained using a functional method. This method is motivated by such results found in [4] and [5] when dealing with singular parabolic systems and the related references within.

Keywords: bounded solutions, singular parabolic systems, Dirichlet problems

1. Introduction

In this paper, we consider the following parabolic system:

$$\begin{cases} u_t = \Delta u + \dfrac{f(x)}{v^p}, & \\ v_t = \Delta v + \dfrac{g(x)}{u^q}, & t > 0, x \in \Omega, \\ u(x,0) = u_0(x),\ v(x,0) = v_0(x), & x \in \Omega, \\ u(x,t) = v(x,t) = 0, & x \in \partial\Omega, \end{cases} \tag{1.1}$$

in a smooth and bounded domain $\Omega \subset \mathbf{R}^N$ with $N \geq 1$. This system is a natural extension of various related problems concerned with a single equation. Such problems arise in relation to the study of enzyme kinetics, as well as in relations to some problems in physics when considering the steady state solutions. Enzyme kinetics is a form of reaction-diffusion processes, specifically chemical reactions catalyzed by enzymes. Enzymes are biological molecules which help complex reactions to occur virtually everywhere in life. Understanding how these chemical reactions occur is crucial to our understanding of metabolic processes and how they occur

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