

ON THE CONVERGENCE RATES FOR SOLUTIONS OF SOME CHEMICAL INTERFACIAL REACTION PROBLEMS

MASATO IIDA, YOSHIO YAMADA AND SHOJI YOTSUTANI

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1. Introduction

In this paper, we treat some diffusion equations with a nonlinear system of boundary conditions, which appear in chemical engineering. Our concern is to investigate the asymptotic behavior of solutions to the following initial boundary value problem in $\bar{I} \times (0, \infty)$:

$$(P) \quad \left\{ \begin{array}{l} a(x) \frac{\partial u}{\partial z} = \frac{\partial^2 u}{\partial x^2}, \quad b(x) \frac{\partial v}{\partial z} = \frac{\partial^2 v}{\partial x^2} \quad \text{for } (x, z) \in I \times (0, \infty); \\ \frac{\partial u}{\partial x}(0, z) = R_1(u(0, z), v(0, z)), \quad \frac{\partial v}{\partial x}(0, z) = R_2(u(0, z), v(0, z)), \\ \frac{\partial u}{\partial x}(1, z) = 0, \quad \frac{\partial v}{\partial x}(1, z) = 0 \quad \text{for } z \in (0, \infty); \\ u(x, 0) = \phi_1(x), \quad v(x, 0) = \phi_2(x) \quad \text{for } x \in I. \end{array} \right.$$

Here I and \bar{I} denote $(0, 1)$ and $[0, 1]$, respectively; $a(x)$ and $b(x)$ are given functions satisfying

$$(A) \quad \left\{ \begin{array}{l} a \in C^\infty(\bar{I}), \quad b \in C^\infty(\bar{I}), \\ a(x) > 0, \quad b(x) > 0 \quad \text{for } x \in [0, 1), \\ a(1) = b(1) = 0; \end{array} \right.$$

$\phi_i(x)$ ($i=1, 2$) are nonnegative initial data; $R_i(u, v) = k_i R_0(u, v)$ ($i=1, 2$), where k_i ($i=1, 2$) are positive constants and

$$R_0(u, v) = u^m v^n$$

with positive integers m and n .

The problem (P) was proposed by Kawano and Nakashio [5] to describe