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THE BEHAVIOR OF IMPULSIVELY INITIATED THERMAL WAVES IN AN ABSORBING MEDIUM

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Abstract. In plasma physics the thermal waves through an absorbing medium causes several interesting phenomena. In particular, it can be observed from numerical computations that *pulse splitting or non-splitting phenomena* appear, where the model equation is described as some nonlinear diffusion equation with absorption depending on the temperature. Mathematical justification is tried, and some sufficient conditions under which such phenomena occur are given.

Keywords. nonlinear diffusion, finite extinction, interfaces, pulse splitting, difference schemes.

AMS (MOS) subject classification: 35K65, 35B99, 65M12

1 Introduction.

We consider the propagation of thermal waves in absorbing medium in which there is an interaction between diffusion and absorption. In such a medium we may assume that the thermal conductivities and sinks depend on the temperature. The behavior of the initiated thermal waves shows the following interesting phenomena: The support of the pulses, while initially connected, begins to split into multiple connected components in the case where absorption can cool the medium faster than diffusion supplies heat from the the hot area. Thus the *pulse splitting phenomena* appear. In the opposite case, the pulse never splits. In both cases the pulse becomes extinct in a finite time. Such phenomena were introduced by Rosenau and Kamin [14]. Our interest stems from the *pulse splitting phenomena.*

To describe such phenomena we may use the nonlinear diffusion equation with absorption, which is well-known as the description of the flow of the liquids through the homogeneous porous medium. In this paper we are concerned with the one-dimensional problem which is written as the initial value problem:

$$v_t = (v^m)_{xx} - cv^p, \qquad x \in \mathbf{R}^1, \quad t > 0, \tag{1.1}$$

$$v(0,x) = v^0(x), \qquad x \in \mathbf{R}^1. \tag{1.2}$$

Here we have the following assumptions: