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Travelling wave solutions for a drying problem. (English) Zbl 0843.35047

Martin, Gaven (ed.) et al., Proceedings of the miniconference on analysis and applications, held at the University of Queensland, Brisbane, Australia, September 20-23, 1993. Canberra: Australian National University, Centre for Mathematics and its Applications. Proc. Cent. Math. Appl. Aust. Natl. Univ. 33, 107-112 (1994).

A simple model governing the drying of a porous material at a constant wet-bulb temperature is formulated in nondimensional form (with slight modification) as follows:

$$\frac{\partial S}{\partial t}=\frac{\partial}{\partial x}\left\{K_S(S)\frac{\partial S}{\partial x}-K_g(S)\right\}, \tag{1}$$

$$K_S(S)=\begin{cases}\alpha S^3\{f(S)+\frac{5}{S^2}\}, & S>0,\\ 0, & S\le 0,\end{cases}\quad K_g(S)=\begin{cases}\beta S^3, & S>0,\\ 0, & S\le 0,\end{cases}$$

where S is the moisture content and α and β are nondimensional constants which are determined by the properties of the porous material and the drying conditions; $f(S)=\text{const.}+\text{const.}e^{-40(1-S)}$, these constants being positive. Here, x is the vertical axis with positive direction downward and t is time. In this study, we ask whether equation (1) admits travelling plane wave solutions on $-\infty<x<\infty$.

For the entire collection see [Zbl 0816.00015].

MSC:

35K65 Degenerate parabolic equations
76S05 Flows in porous media; filtration; seepage

Keywords:

drying of a porous material; travelling plane wave solutions