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CONTINUOUS DIFFERENTIABILITY OF THE FREE BOUNDARY FOR WEAK SOLUTIONS OF THE STEFAN PROBLEM

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ABSTRACT. We announce a result concerning the continuous differentiability of the unknown boundary curve defined by a weak solution of the one-dimensional two-phase Stefan problem.

We deal with the following two-phase Stefan problem: to determine $u(x, t)$ for $0 \leqq t \leqq T$, $0 \leqq x \leqq 1$ and $s(t)$ for $0 \leqq t \leqq T$ such that (i) $0 < s(t) < 1$, $s(0) = b$; (ii) $u_t = \beta_1 u_{xx}$ for $0 < t \leqq T$, $0 < x < s(t)$ and $u_t = \beta_2 u_{xx}$ for $0 < t \leqq T$, $s(t) < x < 1$; (iii) $u(0, t) = f_1(t) > 0$ and $u(1, t) = f_2(t) < 0$ for $0 \leqq t \leqq T$; (iv) $u(x, 0) = \psi(x)$ for $0 \leqq x \leqq 1$; (v) $u(s(t), t) = 0$ for $0 \leqq t \leqq T$; and (vi) $\alpha \dot{s}(t) = -u_x(s(t) - 0, t) + u_x(s(t) + 0, t)$ for $0 < t \leqq T$. Here and throughout, β_i and α are positive parameters, $b \in (0, 1)$, f_i and ψ are continuous functions with $f_1(0) = \psi(0)$, $f_2(0) = \psi(1)$, $\psi(b) = 0$, $\psi(x) > 0$ for $0 \leqq x < b$, $\psi(x) < 0$ for $b < x \leqq 1$, and $|\psi(x)| \leqq K|b - x|$ for $0 \leqq x \leqq 1$.

Cannon and Primicerio [3], following the work of Cannon, Douglas and Hill [2] showed that this problem has a unique *classical solution* (one for which the expressions appearing in (vi) are defined and continuous for $0 < t \leqq T$) on condition that the f_i and ψ are bounded by certain constants which depend on the parameters of the problem. A. Friedman [4],

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