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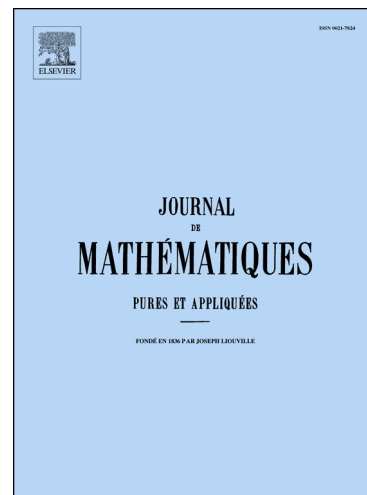
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Regularity for a quasilinear continuous casting problem

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Abstract

In this paper we study the regularity of weak solutions to the continuous casting problem

$$\operatorname{div}(|\nabla u|^{p-2}\nabla u - \mathbf{v}\beta(u)) = 0 \quad (\#)$$

for prescribed constant velocity \mathbf{v} and enthalpy $\beta(u)$ with jump discontinuity at $u = 0$. We establish the following estimates: local log-Lipschitz $p > 2$ for u (and BMO for ∇u) for two phase, Lipschitz $p > 1$ for one phase and linear growth up-to boundary near the contact points. We also prove that the free boundary is continuous curve in the direction of \mathbf{v} in two spatial dimensions. The proof is based on a delicate argument exploiting Sard's theorem for $W^{2,2+\eta}$, $\eta > 0$ functions and circumventing the lack of comparison principle for the solutions of (#).

Dans cet article, nous étudions la régularité des solutions faibles au problème du casting continu

$$\operatorname{div}(|\nabla u|^{p-2}\nabla u - \mathbf{v}\beta(u)) = 0 \quad (\#)$$

pour prescription vitesse constante \mathbf{v} et enthalpie $\beta(u)$ avec une discontinuité de saut à $u = 0$. Nous établissons les estimations suivantes: Log-Lipschitz local $p > 2$ pour u (et BMO pour ∇u) pour deux phases, Lipschitz $p > 1$ pour une phase et une croissance linéaire jusqu'à la limite près des points de contact. Nous prouvons également que le la limite libre est une courbe continue dans la direction de \mathbf{v} en deux dimensions spatiales. La preuve est basée sur un argument délicat exploitant le théorème de Sard pour $W^{2,2+\eta}$, $\eta > 0$ fonctions et contourner le manque de principe de comparaison pour les solutions de (#).

Keywords: Free boundary regularity, two phase, p -Laplace, Stefan problem, continuous casting.

2010 MSC: 35R35, 35J92, 35B65.

1. Introduction

Let $\Omega \subset \mathbb{R}^{N-1}$ be a bounded domain with $C^{1,\alpha}$ boundary. Denote $\mathcal{C}_L = \Omega \times (0, L) \subset \mathbb{R}^N$ where $L > 0$ is given. In what follows we denote the points in \mathcal{C}_L by $X = (x, z)$ where $x \in \Omega$, $z \in (0, L)$.

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