

DIFFERENTIAL GEOMETRY/PDE SEMINAR

FRIDAY, FEBRUARY 1, 2008

PADELDFORD C-401

2:30-3:20 PM

Optimal Regularity and Free Boundary Structure of Signorini
or Thin Obstacle Problems

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The problem of minimizing the Dirichlet integral, or more general integrals which correspond to second order operators, in domain Ω in \mathbb{R}^3 among all functions with prescribed boundary values $f(x)$ and constrained to remain above a prescribed obstacle $\varphi(x)$ when restricted to $(n-1)$ -manifold M in Ω is known as the thin obstacle problem or the n -dimensional Signorini problem.

When studying the regularity of the solution the best that one expects to attain is a $C^{1,1/2}$ on each side of the manifold M even with a smooth $\varphi(x)$. This is indeed the case as it was shown by D. Richardson in 1978 for $n = 2$ and M a hyperplane, for higher dimensions, i.e. when $n \geq 3$, only a $C^{1,\alpha}$ had been achieved for some $0 < \alpha \leq 1/2$ by L. A. Caffarelli (1979).

In a 2004 joint work with L. A. Caffarelli we show that $1/2$ can be obtained for any dimension by making use of the almost concavity of u in the normal direction and considering a monotonicity formula of an appropriate quantity.

This opened the way to study the properties of the interface by using geometric P.D.E. techniques. This is precisely the content of a recent joint work with L. A. Caffarelli and S. Salsa. We show there that there is one basic global non-degenerate profile after blow-up, and that in a neighborhood of a point which has this profile the free boundary is a $C^{1,\alpha}$ curve on the boundary i.e. a $n - 2$ dimensional graph on the $n - 1$ dimensional boundary.

For more information about this seminar, visit the DG/PDE Seminar Web page (from the Math Department home page, www.math.washington.edu, follow the link **Seminars, Colloquia, and Conferences**).

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