DISCONTINUOUS GRADIENT CONSTRAINTS AND THE INFINITY LAPLACIAN

JULIO D. ROSSI
UNIVERSITY OF ALICANTE (SPAIN)

Motivated by tug-of-war games and asymptotic analysis of certain variational problems, we consider the following gradient constraint problem: given a bounded domain $\Omega \subset \mathbb{R}^n$, a continuous function $f : \partial\Omega \to \mathbb{R}$ and a non-empty subset $D \subset \Omega$, find a solution to

$$\begin{cases} \min\{\Delta_\infty u, |Du| - \chi_D\} = 0 & \text{in } \Omega \\ u = f & \text{on } \partial\Omega, \end{cases}$$

where Δ_∞ is the infinity Laplace operator. We prove that this problem always has a solution that is unique if $\overline{D} = \overline{\text{int}D}$. If this regularity condition on D fails, then solutions obtained from game theory and L^p-approximation need not coincide.

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