On the distance function in the presence of an obstacle

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Abstract

We study the Riemannian distance function from a fixed point of $\mathbb{R}^n$ in the presence of a compact obstacle bounded by a smooth hypersurface. First, we show that such a function is locally semiconcave with a fractional modulus of order one half. Then, in the Euclidean setting and under a natural geometrical condition, we prove that the exponent one half is optimal. Furthermore, we show that the singular set is nonempty and that the singularities of the distance function propagate, i.e. each singular point belongs to a nontrivial singular continuum.