# SOME NEW MONOTONICITY FORMULAS AND THEIR APPLICATIONS IN THE OBSTACLE PROBLEM IN CODIMENSION ONE

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ABSTRACT. The obstacle problem in codimension one (also known in elasticity as Signorini problem) arises in several branches of the applied sciences, ranging from elasticity, to mathematical finance. Recently Caffarelli, Salsa and Silvestre have proved the regularity of the free boundary in the lower dimensional obstacle problem at those points of the free boundary which are called regular.

These are the free boundary points at which Almgren's frequency functional attains its least value ($= 3/2$). However, the question of the smoothness of the free boundary near the so-called singular points remained an open problem.

The singular points are those free boundary points of vanishing $(n-1)$-dimensional density.

This is by no means a small set as simple examples show that the free boundary can well be composed exclusively of singular points.

We construct two new one-parameter families of monotonicity formulas which play a crucial role in understanding the structure of the free boundary near a singular point.

With such formulas we can prove the uniqueness of the so-called "blowup" at a singular point and their continuous dependence on the point itself.

These results, in turn, allow to prove a structure theorem for that portion of the free boundary which is made of singular points.

The content of this talk is joint work with Arshak Petrosyan.