REGULARITY OF ELLIPTIC PDES AND THE CONSTRUCTION OF SURFACES OF MINIMUM MEAN CURVATURE VARIATION

PABLO RAÚL STINGA

Surfaces of minimum mean curvature variation were introduced in the early 1990's by UC Berkeley computer scientists Henry P. Moreton and Carlo H. Séquin in order to create complex, smoothly shaped surfaces. These surfaces have certain geometric and mechanical properties that make them fundamental in, for instance, the design of ship hulls and surfaces of cars, data interpolation, reconstruction of corrupted surfaces, and other problems in engineering and computer aided design and manufacture, just to mention a few. Although they are very popular in computational implementation and industrial applications, up to now, there was a lack of solid mathematical theory that actually showed the existence and regularity of these surfaces. Such results are needed to rigorously justify the smoothness that has been observed numerically and to prove rates of convergence of numerical schemes.

We will present a friendly review of some of the most important ideas in the regularity theory of solutions to second order elliptic partial differential equations, starting with the Laplace equation and going all the way to divergence and nondivergence form equations. We will then see how some of these tools apply in the mathematical construction and the proof of regularity estimates of surfaces of minimum mean curvature variation.

References

[1] L. A. Caffarelli, P. R. Stinga and H. Vivas, A PDE approach to the existence and regularity of surfaces of minimum mean curvature variation, *Arch. Ration. Mech. Anal.* **248** (2024), Paper No. 70, 17 pp.

[2] P. R. Stinga, *Regularity Techniques for Elliptic PDEs and the Fractional Laplacian*, with a foreword by Luis A. Caffarelli and José L. Torrea, CRC Press, Boca Raton, FL, 2024.