Preface

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Since its early days, the study of geometric variational problems has been a major driving force in the development of Geometric Measure Theory (GMT). Quoting from the preface of Federer's treatise (1969):

During the last three decades the subject of geometric measure theory has developed from a collection of isolated special results into a cohesive body of basic knowledge with an ample natural structure of its own and with strong ties to many other parts of mathematics. These advances have given us deeper perception of the analytic and topological foundations of geometry, and have provided new direction to the calculus of variations. Recently the methods of geometric measure theory have led to very substantial progress in the study of quite general elliptic variational problems, including the multidimensional problem of least area.

Since the time these words have been written, the importance of GMT in other areas of Mathematics has exponentially increased, with striking applications to the understanding of geometric objects and of variational models used in Physics and in other applied sciences. The deeper questions usually arise in addressing regularity issues, and in particular, in understanding the structure of singular sets and the near-to-singularities behavior of minimizers/critical points of geometric functionals and of free-energies.

This special issue aims to draw the attention of readers on two very important and lively areas of research that well exemplify this situation: the regularity theory of area minimizing currents in codimension higher than one, a classical and fundamental problem in the theory of least area; and the regularity theory for free-discontinuity problems, a large class of variational problems arising in such diverse areas of applied Mathematics like image reconstruction and fracture mechanics.

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special issue, which will hopefully serve to stimulate further investigation on these beautiful mathematical problems.