Luca Rondi

A variational approach to the reconstruction of cracks by boundary data

We consider a conducting body which presents some (unknown) perfectly insulating defects, such as cracks or cavities, for instance. We aim to reconstruct the defects by performing measurements of current and voltage type on a (known and accessible) part of the boundary of the conductor. A crucial step in this reconstruction is the determination of the electrostatic potential u inside the conductor, by the electrostatic boundary measurements performed. Or, in other words, the determination of the harmonic function u by its (measured) Cauchy data on a known and accessible part of the boundary.

Since the defects are unknown, we state such a determination problem as a free-discontinuity problem for the electrostatic potential in the framework of special functions of bounded variation. The corresponding variational formulation consists of the minimization of a suitable functional which depends only on the (possibly noisy) boundary data. The functional takes into account the error in the measurements and contains as a regularizing term the so-called Mumford-Shah functional.

Luca Rondi
Università degli Studi di Trieste
Dipartimento di Matematica e Informatica
via Valerio, 12/1
34127 Trieste Italy
`rondi@units.it`
http://www.dmi.units.it/~rondi/