Singular-Superposition Method for the Inverse Geometric Problem - applications in heat transfer and elasticity.

Alain J. Kassab
Mechanical, Materials, and Aerospace Engineering
University of Central Florida
Orlando, Florida, 32816, USA
kassab@mail.ucf.edu

Eduardo A. Divo
Engineering Technology Departement
University of Central Florida
Orlando, Florida, 32816, USA
edivo@mail.ucf.edu

A method is presented for the efficient solution of the inverse geometric problem applied to detection of subsurface cavities and flaws using additional information provided by thermographic or mechanical measurements. A hybrid method, consisting of the superposition of clusters of sources/sinks in thermal applications or point forces or loads in mechanical applications either of which is coupled to a boundary element field solution of the forward problem. The singularities are adjusted to satisfy the measured quantities and a search is subsequently undertaken to determine the flaw(s) or cavity(ies) location(s). The numerical scheme avoids re-meshing of the interior geometry as it evolves in the process of solving the inverse problem iteratively to detect the subsurface flaw(s) or cavity(ies). The hybrid approach markedly reduces the computational burden involved in solving the inverse problem and presents a promising technique for practical 3D applications. We present examples both in heat transfer and elasticity.