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On some nonlinear inverse problems in elasticity. (English) $\boxed{\text{Zbl 1313.74042}}$

Summary: We make a review of some inverse problems in elasticity, in statics and dynamics, in acoustics, thermoelasticity and viscoelasticity. Crack inverse problems have been solved in closed form, by considering a nonlinear variational equation provided by the reciprocity gap functional. This equation involves the unknown geometry of the crack and the boundary data. It results from the symmetry lost between current fields and adjoint fields which is related to their support. The nonlinear equation is solved step by step by considering linear inverse problems. The normal to the crack plane, then the crack plane and finally the geometry of the crack, defined by the support of the crack displacement discontinuity, are determined explicitly. We also consider the problem of a volumetric defect viewed as the perturbation of a material constant in elastic solids which satisfies the nonlinear Calderon's equation. The nonlinear problem reduces to two successive ones: a source inverse problem and a Volterra integral equation of the first kind. The first problem provides information on the inclusion geometry. The second one provides the magnitude of the perturbation. The geometry of the defect in the nonlinear case is obtained in closed form and compared to the linearized Calderon's solution. Both geometries, in linearized and nonlinear cases, are found to be the same.

MSC:

74D10	Nonlinear constitutive equations for materials with memory
74A45	Theories of fracture and damage
65N21	Numerical methods for inverse problems for boundary value problems involving PDEs

Keywords:

nonlinear fracture mechanics; symmetry loss; material constants perturbation; defect geometry

Full Text: DOI