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THE DIRECT METHOD OF FUNDAMENTAL SOLUTIONS AND THE INVERSE KIRSCH-KRESS METHOD FOR THE RECONSTRUCTION OF ELASTIC INCLUSIONS OR CAVITIES

CARLOS J. S. ALVES AND NUNO F. M. MARTINS

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This paper is dedicated to Professor Rainer Kress on the occasion of his 65th birthday.

ABSTRACT. In this work we consider the inverse problem of detecting inclusions or cavities in an elastic body, using a single boundary measurement on an external boundary. We discuss the identifiability questions on shape reconstruction, presenting counterexamples for Robin boundary conditions or with additional unknown Lamé parameters. Using the method of fundamental solutions (MFS) we adapt a method introduced twenty years ago by Andreas Kirsch and Rainer Kress [**20**] (in the context of an exterior problem in acoustic scattering) to this inverse problem in a bounded domain. We prove density results that justify the reconstruction of the solution from the Cauchy data using the MFS. We also establish some connections between this linear part of the Kirsch-Kress method and the direct MFS, through matrices of boundary layer integrals. Several numerical examples are presented, showing that with noisy data we were able to retrieve a fairly good reconstruction of the shape (or of its convex hull) with this MFS version of the Kirsch-Kress method.

1. Introduction. The identification of inclusions or cavities in an elastic body from external boundary measurements is a problem in nondestructive testing. This is an inverse problem that aims to reconstruct the shape and location of the burried object from the knowledge of the Cauchy data. This problem has been addressed in the literature for both scalar and vectorial potential problems with different boundary conditions. For the Laplace equation, with applications in

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