Lipschitz stability estimate and reconstruction of Lamé parameters in linear elasticity

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Abstract

We consider the inverse problem of recovering an isotropic elastic tensor from the Neumann-to-Dirichlet map. To this end, we prove a Lipschitz stability estimate for Lamé parameters with certain regularity assumptions. In addition, we assume that the Lamé parameters belong to a known finite subspace with a priori known bounds and that they fulfil a monotonicity property. The proof relies on a monotonicity result combined with the techniques of localized potentials. To numerically solve the inverse problem, we propose a Kohn-Vogelius-type cost functional over a class of admissible parameters subject to two boundary value problems. The reformulation of the minimization problem via the Neumann-to-Dirichlet operator allows us to obtain the optimality conditions by using the Fréchet differentiability of this operator and its inverse. The reconstruction is then performed by means 1of an iterative algorithm based on a quasi-Newton method. Finally, we give and discuss several numerical examples.