

1156-65-336

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*Comparison of variational formulations for the direct solution of an inverse problem in linear elasticity.*

Given one or more observations of a displacement field within a linear elastic, isotropic, incompressible object, we seek to identify the material property distribution within that object. This is a mildly ill-posed inverse problem in linear elasticity. While most common approaches to solving this inverse problem use forward iteration, several variational formulations have been proposed that allow its direct solution (i.e. solution without iteration). We review five such direct variational formulations for this inverse problem: Least Squares, Adjoint Weighted Equation, Virtual Fields, Inverse Least Squares, and Direct Error in Constitutive Eqn. We briefly review their derivations, their mathematical properties, and their compatibility with Galerkin discretization and numerical solution. We demonstrate these properties through numerical examples. (Received January 27, 2020)