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A MODIFIED ERROR IN CONSTITUTIVE EQUATIONS APPROACH FOR INVERSE PROBLEMS IN FREQUENCY DOMAIN ELASTODYNAMICS

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In this work, we present a simplified inverse problem methodology based on modified error in constitutive equations (MECE) for the identification of elastic properties undergoing time harmonic excitations. The basic premise in the MECE approach is that, given an over-determined set of boundary or internal data (e.g. displacements and tractions), and a set of kinematically admissible displacements and statically admissible stresses, a cost functional is defined based on the error in the constitutive equations that connect these sets of stresses and strains [1, 2]. In sharp contrast to the standard L_2 based cost functional, wherein, the discrepancy between measured and computed response are minimized, MECE based cost functional are formed more rationally by considering a set of reliable and unreliable entities. This cost functional has been shown to be convex for elliptic problems [3], and presents significant advantages for inverse elasticity problems.

In the present exploration we considered steady state response in elasto-dynamics with general anisotropic constitutive linear elasticity tensor under MECE setup. An element based material update equation is explicitly derived. In particular we show a simplified update procedure that does not required any minimization routines. We also address the computational issues within this framework. Moreover we demonstrate that MECE approaches can yield faster convergence and better accuracy than approaches based on the minimization of the L_2 norm.

References

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