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An Error in Constitutive Equation Approach for Frequency-Domain Viscoelasticity Imaging Using Interior Data

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We present a methodology for the inverse identification of linearly viscoelastic material parameters in the context of steady-state dynamics using interior data. In this methodology, the inverse problem of viscoelasticity imaging is solved by minimizing a generalized error in constitutive equation (ECE) functional subject to the conservation of linear momentum, without introducing boundary conditions, as a constraint. The generalized ECE functional measures the discrepancy in the constitutive equations that connect kinematically admissible strains and dynamically admissible stresses and at the same time incorporates the measurement data in an additional quadratic penalty term. Regularization of the problem is achieved through a penalty parameter in combination with the discrepancy principle due to Morozov. Numerical results demonstrate the robust performance of the method in situations where the available measurement data is incomplete and corrupted by noise of varying levels.

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