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ADVANCED COMPUTATIONAL FORMULATIONS FOR BOUNDARY-CONDITION FREE ELASTICMODULUSRECONSTRUCTIONSFROMPARTIAL INTERIOR DATA

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Quantitative elastic modulus imaging from quasistatic displacement data requires the solution of an inverse elasticity problem. The inverse problem formulation generally requires specification of either displacement or traction boundary conditions. Most current ultrasound devices are not capable of measuring traction data, and the measured displacement field is noisy. The incomplete and imprecise nature of the available boundary information often necessitate that educated guesses be made in order to have adequate knowledge of the boundary conditions to compute mechanical properties. These assumed boundary conditions, however, are known to lead to errors in the reconstructions. This abstract proposes a method to perform reconstructions without knowing the boundary conditions a priori. This method relies on using the equilibrium equation constraints and an optimization algorithm to estimate the modulus field. The method was verified with simulated displacement data, validated with phantom displacement data, and applied to in-vivo displacement data measured from patients with breast masses. [Authors gratefully acknowledge funding from NSF and NIH (NSF Grant No. 50201109; NIH NCI R01CA140271).]