Theme: Applied physiology; PET and MR imaging

Trust region method for the inverse problem of elastography

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Abstract:
Our main goal is to develop an Optical Coherence Elastography (OCE) technique to assess the biomechanical properties of the murine retina. Such technique requires an adequate biomechanical model of the tissue as well as an inverse optimization algorithm to reconstruct the tissue's viscoelastic properties.
With that in mind, we present an inverse problem scheme that couples with our viscoelastic numerical model - a mixed Finite Element Method (FEM) based on the weak formulation of the time-dependent linear elasticity equation. The inverse algorithm is based on a trust region method, where one dimensional regions of elastic modulus values are iteratively subdivided until the objective function, a squared differences formulation of the time-dependent displacements at a sub-boundary of interest, is optimized.
The results demonstrate the ability of the inverse algorithm to reconstruct the elastic modulus that generated the simulated data within few iterations, paving the way for the reconstruction of biomechanical properties with real OCE data.

Keywords: OCE; FEM; inverse problem.