# Forward and inverse problems in multiphase mechanics of soft tissues


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## Abstract


A host of imaging techniques are currently available that can image and quantify tissue displacement and strain in vivo. Combining these displacement measurements with a constitutive equation for the tissue and appropriate conservation laws results in an inverse problem for the tissue biomechanical properties. In most previous applications, the constitutive model for the tissue is assumed to be elastic or viscoelastic. It is well recognized, however, that soft tissues contain both fluid and solid phases. Furthermore, the fluid may flow within and between several different compartments. In earlier work, we used a mathematical model of vascularized soft tissue, which includes the effects of fluid flow and the possibility of exchange between fluid compartments, to show the spatio-temporal patterns of elastic strain in soft tissue relaxation resulting from interstitial fluid flow. In the present work we formulate and solve an inverse problem consisting of reconstructing the filtration coefficient given the stiffness distribution and the spatio-temporal pattern of strain relaxation. The knowledge of the spatial distribution of the filtration coefficient may be used to detect and characterize regions of angiogenesis, which may strongly indicate cancer and be used for staging, prognosis and monitoring treatment.