Imaging localized force displacements in cells and tissues from substrate displacements[1] JOSHUA CHANG, Natl Inst of Health - NIH, TOM CHOU, University of California Los Angeles — We develop a method to reconstruct, from measured displacements of the underlying elastic substrate, the spatially dependent forces that cells or tissues impart on them. Since these sources of force typically arise from focal adhesions, with are localized or compact," and discontinuous, we solve this inverse problem using methods of optimization useful for image segmentation. In addition to the standard quadratic data mismatch terms (that defines least-squares fitting), we motivate a term in the objective function which penalizes variations in the reconstructed stress eld while preserving boundaries and physical knowledge. By minimizing the objective function subject to physical constraints, we are able to efficiently reconstruct stress fields with localized structure from simulated and experimental substrate displacements. We provide a numerical algorithm for setting up the discretized problem and under loose regularity conditions for the underlying stress tensor, provide bounds on the reconstruction error.

[1]NIH, ARO

Joshua Chang
Natl Inst of Health - NIH

Date submitted: 14 Nov 2016

Electronic form version 1.4