Abstract Submitted
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Heterogeneous Force Chains in Cellularized Biopolymer Networks[1] LONG LIANG, Department of Physics, Arizona State University, CHRISTOPHER ALLEN RUCKSACK JONES, DANIEL LIN, BO SUN, Department of Physics, Oregon State University, YANG JIAO, Department of Material Sciences, Arizona State University — Biopolymer Networks play an important role in coordinating and regulating collective cellular dynamics via a number of signaling pathways. Here, we investigate the mechanical response of a biopolymer network due to the active contraction of embedded cells. Specifically, a graph (bond-node) model derived from confocal microscopy data is used to represent the network microstructure, and cell contraction is modeled by applying correlated displacements at specific nodes, representing the focal adhesion sites. A force-based stochastic relaxation method is employed to obtain force-balanced network under cell contraction. We find that the majority of the forces are carried by a small number of heterogeneous force chains emitted from the contracting cells. The mechanisms of the emergence of force chains is discussed, Large fluctuations of the forces along different force chains are observed. Importantly, the decay of the forces along the force chains is significantly slower than the decay of radially averaged forces in the system. These results demonstrated how the fibrous structure of biopolymer network could support long-range force transmission and thus, long-range mechanical signaling between remote cells.

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