



FRONTIERS IN MICRORHEOLOGY



Mechanics of cytoskeletal networks with highly flexible cross-linkers

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Abstract: Recent *in vitro* experiments on actin networks with the physiological cross-linker filamin have shown very striking non-linear elastic behavior, including more than 1000-fold stiffening under strain. This behavior appears to be due to the large compliance of filamin, although the fundamental mechanism of the observed response is not understood. We present a model for actin filaments cross-linked by a large compliant linker such as filamin. Specifically, we treat such a composite network as a collection of stiff polymers mechanically connected by flexible cross-linkers to an effective elastic continuum, which self-consistently represents the non-linear elasticity of the surrounding network. This model results in linear elasticity dominated by the cross-linkers for low strains followed by strain-stiffening as the cross-linkers reach full compliance. Our model is in quantitative agreement with the observed nonlinear response.



The Frontiers in Microrheology Workshop
February 6 - February 9, 2008
at the CNSI, UCLA

<http://www.cnsi.ucla.edu/conferences/microrheology/>

