Abstract Submitted
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Elasticity of 3D networks with rigid filaments and compliant crosslinks[1] KNUT M. HEIDEMANN, Institute for Numerical and Applied Mathematics, Georg-August-Universität, Göttingen, Germany, ABHINAV SHARMA, FLORIAN REHFELDT, CHRISTOPH F. SCHMIDT, Third Institute of Physics — Biophysics, Georg-August-Universität, Göttingen, Germany, MAX WARDETZKY, Institute for Numerical and Applied Mathematics, Georg-August-Universität, Göttingen, Germany — Disordered filamentous networks with compliant crosslinks exhibit a low linear elastic shear modulus at small strains, but stiffen dramatically at high strains. Here, we perform an analytical and numerical study on model networks in three dimensions. Our model consists of a collection of randomly oriented rigid filaments connected by flexible crosslinks that are modeled as wormlike chains. Under the assumption of affine deformations in the limit of *infinite* crosslink density, we show analytically that the nonlinear elastic regime in 1- and 2-dimensional networks is characterized by power-law scaling of the elastic modulus with the stress. In contrast, 3-dimensional networks show an exponential dependence of the modulus on stress. Independent of dimensionality, if the crosslink density is *finite*, we show that the only persistent scaling exponent is that of the single wormlike chain. Consequently, unlike suggested in prior work, the model system studied here cannot provide an explanation for the experimentally observed linear scaling of the modulus with the stress in filamentous networks.

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Knut M. Heidemann
Institute for Numerical and Applied Mathematics,
Georg-August-Universität, Göttingen, Germany

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