Mechanics of Anisotropic Semiflexible Gels

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We present the results of analytic and numerical investigations into the mechanics of anisotropic semiflexible gels. Previous work has uncovered the existence of an affine/non-affine crossover as a function of the density of cross-links in the semiflexible filament network. The affine regime is characterized by a spatially homogeneous strain field and filament stretching under applied shear strain, while the non-affine regime is characterized by a spatially heterogeneous strain field and filament bending. Previous studies focused on statistically isotropic networks. Here we explore the effect of network anisotropy on the affine/non-affine crossover. We examine elastic energy storage and the geometry of the displacement field in networks having a non-vanishing nematic order parameter under both shearing and stretching deformations. Understanding the impact of filament anisotropy on the affine/non-affine crossover may inform the biophysical study of cellular mechanics where the filamentous networks have locally preferred directions.

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