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On the role of geometric non-linearities in the mechanics of nematically ordered semi-flexible networks LOUIS FOUCARD, Department of Chemistry and Biochemistry, UCLA, JORDAN KAZUO PRICE, WILLIAM KLUG, Department of Mechanical and Aerospace Engineering, UCLA, ALEX LEVINE, Department of Chemistry and Biochemistry, UCLA — Extending previous studies on the affine-nonaffine transition of nematically ordered semiflexible networks, we investigate numerically the effect of geometric non-linearities on the mechanical response of anisotropic networks of elastic filaments. We find that the strong dependence of buckling susceptibility on segment length has a pronounced effect on the nonlinear elastic behavior of anisotropic networks; contrary to isotropic networks, highly ordered ones show an important softening of the shear modulus at nonlinear (finite) strains. We compute the spatial correlation of the Conti/McKintosh buckling order parameter and show that the particularity of the nonlinear response of nematic networks resides in the cooperativity of the buckling events. We also show that dependence of the shear modulus on the nematic order parameter can be predicted using the assumption of affine deformation at small shear, and in terms of a generalized floppy mode analysis of the nonaffine mechanics at larger deformation.

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