

When are semisoft elastomers soft?

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We consider a relaxed semisoft elastomer with its director oriented along the z axis that is first subjected to a large stretch in the x direction then to a slight x-z shear. We demonstrate by symmetry that any theory coupling director rotation to strain will predict zeroes in the modulus for this small shear (the C5 modulus) when the large stretch takes the elastomer to the onset or end of director rotation, and display the full C5-strain curve predicted by one model of semi-soft elastomers arising from compositional fluctuations. The compositional fluctuations model has predicted the stress-strain and strain-director rotation curves of real elastomers very successfully, despite its very restricted microscopic derivation. We suggest this is because it is in fact a generic form, showing it is the only admissible free energy that is quadratic in the deformation gradient tensor and incorporates a single reference state direction - the initial director.

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Semisoft elastic response of nematic elastomers to complex deformations

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