Soft elasticity in nematic elastomers: Analysis and computation

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Nematic elastomers are polymeric materials which combine the elastic properties of rubbers with the optical properties of nematic liquid crystals. From a mechanical viewpoint, they behave at high temperature as isotropic rubbers, whereas below the phase-transition temperature soft deformation up to large strains is possible. In the latter regime, typical equilibrium configurations exhibit fine-scale oscillations of the state variables. Mathematically, this corresponds to the fact that the appropriate scale-invariant free-energy density is not quasiconvex.
We shall discuss recent results on the mathematical modelling and simulation of the soft elastic reponse of nematic elastomers. In particular, we shall show how the combination of an analytical relaxation of the energy density with accurate numerical simulations has permitted to assess the range of validity of two different microscopic models. This talk is based on joint work with A. DeSimone and G. Dolzmann.

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