

A structure preserving discretization for the Ericksen model with colloidal effects and external fields

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We present a finite element method (FEM) for computing equilibrium configurations of liquid crystals with variable degree of orientation. The model consists of a Frank-like energy with an additional “ s ” parameter that allows for line defects with finite energy, but leads to a degenerate elliptic equation for the director field. Our FEM uses a special discrete form of the energy that does not require regularization, and allows us to obtain a stable (gradient flow) scheme for computing minimizers of the energy. We apply our method to investigate the behavior of colloidal inclusions in the Ericksen model. We also include external fields to model the so-called “Freedricksz Transition”. Simulations in 2-D and 3-D are presented to illustrate the method.

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