A Blend of Stretching and Bending in Liquid Crystal Networks

Epifanio G. Virga, University of Pavia

Liquid crystal networks are elastic soft materials highly responsive to thermal and optical stimuli. When shaped as thin sheets, they become ‘soft machines’, easily activated, which do mechanical work by changing their shape. The appropriate form of the stored elastic energy which governs such flexible sheets is still debated. Undoubtedly, the stretching energy, excited by the external stimuli, is the dominant component. But, by geometric compatibility, stretching generally entrains bending with it, at and added energy cost. By extending the Kirchhoff-Love hypothesis of classical shell theory to the Warner-Terentjev neo-classical energy for nematic elastomers, we derive (and discuss) a bending energy for thin sheets of liquid crystal networks.