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Finite Element Elastodynamics Studies of Shape Evolution in Liquid Crystal Elastomers[1] ROBIN SELINGER, BADEL MBANGA, JONATHAN SELINGER, Kent State University — Liquid crystal elastomers change shape under heating/cooling, applied fields, or optical illumination, with induced strains up to 400%. We present a novel finite element elastodynamics technique to model dynamics of shape change in these materials, with explicit coupling between nematic order and elastic strain. Without added dissipation, the elastodynamics algorithm conserves the sum of kinetic and potential energy to one part in 10^6, even for large strains and rotations. In initial studies, we model shape evolution during a transition from the isotropic phase to nematic and back again, and model the induced curvature of an elastomer strip under local optical illumination. This method allows modeling of complex geometries and dynamic perturbations, and can serve as a bridge between fundamental soft condensed matter theory and engineering design.

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