ROBIN SELINGER

Liquid Crystal Institute
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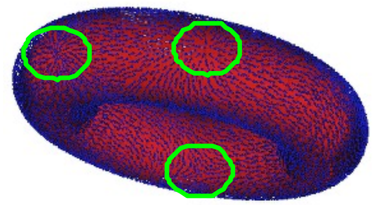
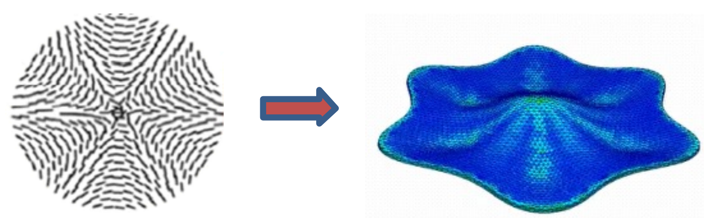
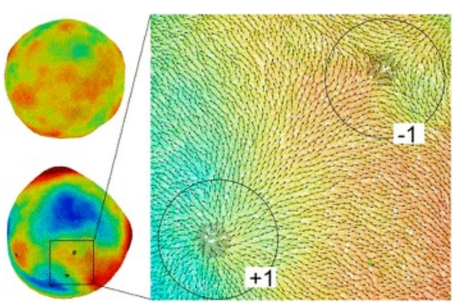


Soft materials with orientational order can undergo dramatic shape transformations driven by change of temperature or other stimuli. Nematic elastomers, a form of liquid crystal polymer, have been patterned to perform "auto-origami," deforming from a flat film into twisted, bent, folded, and curved shapes on heating or cooling. Lipid vesicles, during a phase transition from an untilted to a tilted phase, deform from smooth spheres to crumpled, disordered shapes. In both of these materials, topological defects play a key role: they drive shape change by inducing curvature. Conversely, a liquid crystal enclosed in a confined geometry may have topological defects even in its lowest energy state, induced by imposed curvature. We categorize these various material systems into three classes: 1. Microstructure fixed and shape evolves; 2. Shape fixed and microstructure evolves; and 3. Both shape and microstructure evolve with competing kinetics. We explore mechanisms by which each of these processes can give rise to a deterministic shape transformation or else get trapped in long-lived metastable states. To explore these pattern-formation processes, we use a simulation techniques including coarse-grained particle-based models of lipid membranes, nonlinear finite element simulation of elastic solids, continuum models of liquid crystal textures, and statistical physics models of defects in curved geometries, comparing to relevant experiments. Besides examining fundamentals of pattern formation, we also use simulation methods to explore engineering design and discuss the related inverse problem of topology optimization to achieve target shape transformations.

"From Microstructure to Morphology: Topological Defects, Shape Evolution, and Auto-Origami in Soft Matter"





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Friday, October 28, 2016 - 3:10 pm

Franklin Miller, Jr. Lecture Hall - Hayes 109

Reception to follow in the lobby of Hayes.

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