20th European Mechanics of Materials Conference - EMMC20
Florence, Italy | May 27th-29th, 2026
www.emmc20.unifi.it

Reshaping Liquid Crystal Elastomers with Light

John Biggins[1]

[1] University of Cambridge, United Kingdom. jsb56@cam.ac.uk

Paper ID: 592
Symposium S7: Mechanics of soft materials and structures

Abstract

Liquid crystal elastomers (LCEs) are soft rubbery solids with an underlying molecular alignment. Upon heating, they exhibit a phase transition to isotropic which which induces a large contractile actuation, reminiscent of a muscle. I will discuss two systems made from bi-morph type LCE ribbons that bend on heating, and which are then illuminated with a patterned light source to photo-thermally induce spatio-temporal patterns of preferred bend. In the first system, waves of bending actuation produce a peristaltic pump. In the second, the ribbon is clamped in a bi-stable arch configuration, and patterns of bend are designed to drive both snapping and continuous switching between the up and down states. This second system involves in-situ shape monitoring and closed loop feedback between stimulation and shape. Finally, I will discuss how the orientation direction in LCEs can rotate under load ("soft elasticity"), enabling new classes of actuators based on rotation rather than order/disorder, and present tentative experimental results suggesting that such actuation can be driven by light, enabling large shape changes that persist even after stimulation is removed.

Keywords:

Nematic Elastomer Light Actuation