Electronic Supplementary Material (ESI) for Soft Matter.
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Supplemental Information

SoftMatter
Title: Topology Optimization for the Design of Folding Liquid Crystal Elastomer Actuators
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List of Supplemental Figures:

Figure S1: Strain vs Temperature Profile

Figure S2: Comparison of Linear vs Nonlinear Mechanical Analysis

Figure S3: Target Shape Schematic

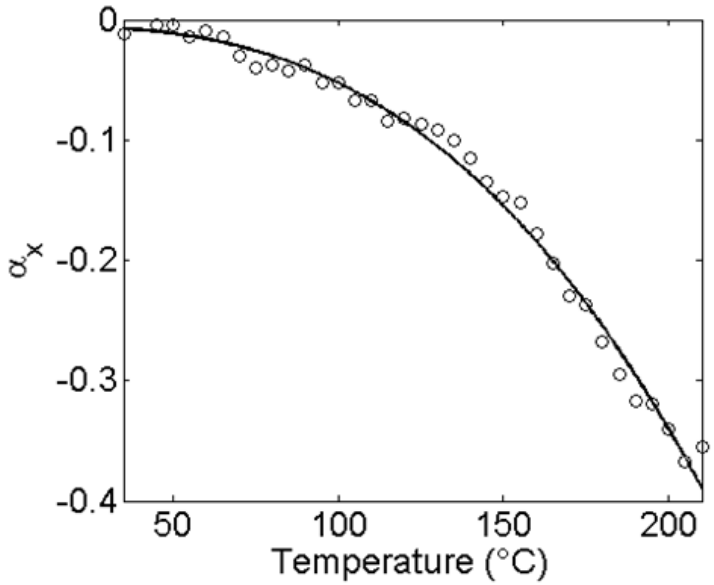

Fig. S1 On heating the LCE contracts along the director. This is shown by plotting the strain (normalized with respect to the initial sample dimensions) as a function of temperature for a uniaxially aligned liquid crystal elastomer. (Data adapted from Ref. 6)

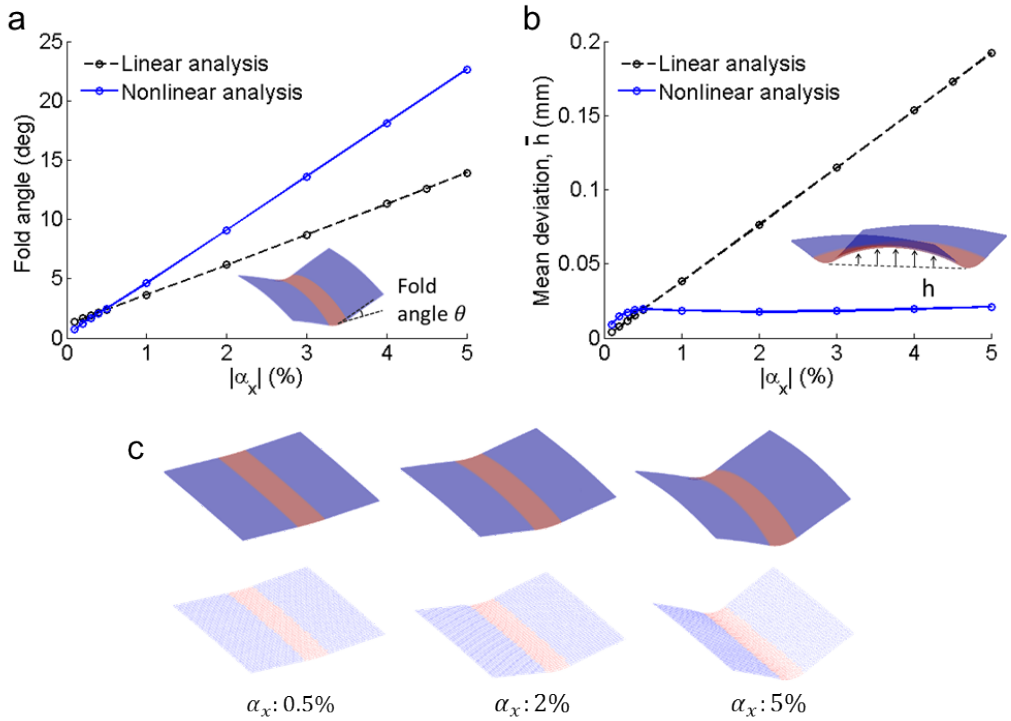

Fig. S2 Comparison of linear and nonlinear simulations of a 20% twisted nematic hinge. a) Fold angle vs. strain exhibits a smaller slope in linear analysis due to shear locking at large strain values. b) Mean deviation of the centerline from flat vs. strain tapers off around 0.5% strain in nonlinear analysis but is extrapolated in linear analysis. c) Deformed twisted nematic shapes at various 0.5%, 2% and 5% strains.

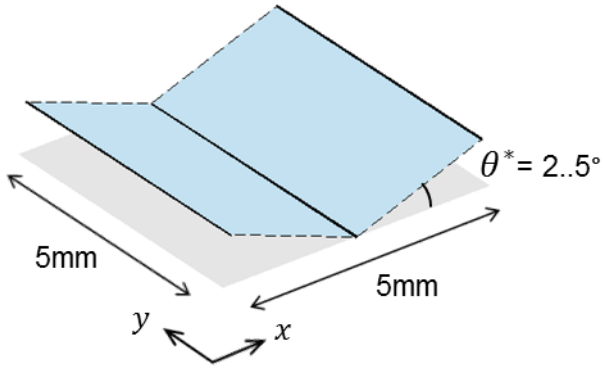

Fig. S3 The target shape for the optimization process. The deformation of the current design is compared to the target deformation along the centreline and edges (solid lines) and used to calculate the objective function in Eq. (5). The target shape follows a perfect hinge folded symmetrically with a 2.5° inclination.