

Abstract Submitted
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Experimental Study of Energy Scaling in Non-Euclidean Plates

Yael Klein, Hebrew University of Jerusalem, Eran Sharon, Hebrew University in Jerusalem — We present an experimental study of the three-dimensional (3D) configurations that result from non-uniform lateral growth/shrinking of thin elastic sheets. We construct environmentally responsive hydrogel plates that shrink non-uniformly when heated above 33°C. This process prescribes a non-Euclidean “target” metric on the sheets. In order to reduce their energy, the plates buckle into 3D configurations associated with their target metric. We study the variations in sheet configurations with decreasing thickness. We observe two types of behaviors: sheets with imposed positive Gaussian curvature have weak thickness dependence, their bending content is bounded and their total bending energy scales like thickness cube. On the other hand, sheets with imposed negative Gaussian curvature undergo a set of bifurcations, as they obtain configurations with increasing number of nodes as thickness decreases. As a result their bending content increases with decreasing thickness, causing the bending energy to scale like the square of the thickness.

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