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Bifurcation of Self-folded Planar Bilayers ARIF ABDULLAH, University of Illinois at UrbanaChampaign, K. JIMMY HSIA, Carnegie Mellon University — Stimuli-responsive curving of thin shells, also known as self-folding, is a topic of substantial technological importance due to its applicability toward a broad range of shape transforming structures. The morphing of shell-like structures in response to external stimuli, is often governed by geometric nonlinearities. One such example is the bifurcation buckling phenomenon of planar bilayers. When thin bilayers are subjected to external stimuli in the form of biaxial mismatch strain, they form shallow spherical caps at lower strains but bifurcate to cylindrical shapes at higher strains in an effort to minimize stretching, which is energetically less favorable. In this work, we investigated the bifurcation behavior of thin planar bilayers as they transform into three-dimensional shapes in response to external stimuli. Through a combination of finite element analysis and experiments, we demonstrated how different structural parameters affect the bilayer behavior prior to bifurcation and also in the post-buckling regime. The insights obtained from this work will contribute toward the design of self-folding functional devices for sensing, robotics, and biomedical applications across multiple length scales.

Arif Abdullah
University of Illinois at UrbanaChampaign

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