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The role of substrate pre-stretch on post-wrinkling bifurcations ANESIA AUGUSTE, University of Massachusetts Amherst, LIHUA JIN, ZHIGANG SUO, Harvard University, RYAN HAYWARD, University of Massachusetts Amherst — Wrinkles in compressed elastic bilayers, resulting from a balance between the bending energy of a stiff skin layer and the stretching energy of a softer substrate, have been applied in a variety of contexts including to change the wetting, optical, and adhesive properties of surfaces. Previous work has shown that at large compression, wrinkles transition into sub-harmonic modes and eventually form ridges or self-contacting folds due to the non-linearity of the substrate elasticity. However, our understanding of how pre-stretch of the substrate affects period doubling and other post-wrinkling bifurcations remains incomplete. We have performed a combined experimental and numerical study wherein the strain state in each layer can be independently varied. We find shifts in the critical strain for post-wrinkling bifurcation and, at high substrate pre-compression, the emergence of "chaotic" patterns with irregular spacings between the troughs that grow in amplitude. Our findings highlight the critical importance of substrate pre-stretch in determining the nature of post-wrinkling bifurcation modes.

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