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Snakes and labyrinths: instability driven pattern formation in thin elastic films.

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Intricate patterns are abundant in nature, from the stripes of a zebra, to the formation of snowflakes, to the wavy peaks and valleys on a beach shore. Instabilities often drive this pattern formation where two competing interactions result in a frustration that is alleviated through the development of these beautiful patterns. One such instability occurs when a soft elastomeric film bonded to a rigid substrate deforms to adhere to an upper rigid surface brought into contact with the film. In this system, the balance of interfacial surface energy and elastic strain energy leads to distinct labyrinth patterns. We study the formation of this adhesion-induced instability by indenting elastomeric films with indenters of various geometries. This indentation method allows us to observe the fingering labyrinth instability both statically to measure wavelength as a function of film thickness, as well as dynamically where we see patterns similar to nanoscale snakes meandering along the ground. We also investigate the effect of film tension on instability growth by observing the pattern go from isotropic to anisotropic as a function of increasing biaxial strain.

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