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Folding of non-Euclidean curved shells[1] NAKUL BENDE, ARTHUR EVANS, University of Massachusetts Amherst, SARAH INNES-GOLD, Tufts University, LUIS MARIN, University of Massachusetts Amherst, ITAI COHEN, Cornell University, CHRISTIAN SANTANGELO, RYAN HAYWARD, University of Massachusetts Amherst — Origami-based folding of 2D sheets has been of recent interest for a variety of applications ranging from deployable structures to self-folding robots. Though folding of planar sheets follows well-established principles, folding of curved shells involves an added level of complexity due to the inherent influence of curvature on mechanics. In this study, we use principles from differential geometry and thin shell mechanics to establish fundamental rules that govern folding of prototypical creased shells. In particular, we show how the normal curvature of a crease line controls whether the deformation is smooth or discontinuous, and investigate the influence of shell thickness and boundary conditions. We show that snap-folding of shells provides a route to rapid actuation on time-scales dictated by the speed of sound. The simple geometric design principles developed can be applied at any length-scale, offering potential for bio-inspired soft actuators for tunable optics, microfluidics, and robotics.

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