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Mechanics and Dynamics of a Snapping Arch DOUGLAS HOLMES, Virginia Tech, MATTHIEU ROCHÉ, TARUN SINHA, HOWARD STONE, Princeton University — Snap-buckling of geometric arches and thin spherical shells occur in a variety of different geometric situations, exhibiting a highly nonlinear response dictated by the geometry and material properties of the system. As this elastic instability often precedes the catastrophic failure of a mechanical system, significant work has focused on the stability criteria for such structures. In order to properly understand the biomechanics of plants that rely on this instability, and in addition use snap-buckling in the design of advanced materials, it is necessary to also develop a fundamental understanding of the timescale and post-buckling response of a snapping structure. Currently, a fundamental understanding of the osmotically-induced snap-buckling phenomena is lacking. In this presentation, we examine the osmotic swelling of a bistable arch to identify the stability criteria, relevant snap-through timescale, and the impact of geometric confinement on snap-through symmetry and damping.

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