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Morphing and Snapping of Plates and Shells via Swelling DOUGLAS HOLMES, Boston University, MATTEO PEZZULLA, PAOLA NARDINOCCHI, Università degli Studi di Roma "La Sapienza", STEVEN SHILLIG, Virginia Tech — Non-homogenous swelling will induce curvature within thin structures - beams will bend and plates will morph into shells. In this work, we examine the dynamics of swelling plates as they deform into shells with either positive or negative Gaussian curvature. The swelling process is driven by a concentration gradient between two partially swollen structures, and the curvature of the final shell is dictated by the geometric arrangement of the swelling materials. The dynamics of this process are driven by diffusion and the geometry of the contact line. We demonstrate that these dynamic deformations can occur over a much faster timescale if the structure is confined. Beginning with a beam bent into an arch, we show how this swelling leads to a snap-through instability with dynamics similar to an arch compressed by a point load. The swelling-induced morphing presented in this talk provides a very simple and controllable way to achieve complex shell structures from simple building blocks.

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