

Abstract Submitted
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Pleated and Creased Structures¹ LEVI DUDTE, ZHIYAN WEI, L. MAHADEVAN, Harvard University — The strategic placement of curved folds on a paper annulus produces saddle-shaped origami. These exotic geometries resulting from simple design processes motivate our development of a computational tool to simulate the stretching, bending and folding of thin sheets of material. We seek to understand the shape of the curved origami figure by applying the computational tool to simulate a thin annulus with single or multiple folds. We aim to quantify the static geometry of this simplified model in order to delineate methods for actuation and control of similar developable structures with curved folds. Miura-ori pattern is a periodic pleated structure defined in terms of 2 angles and 2 lengths. The unit cell embodies the basic element in all non-trivial pleated structures - the mountain or valley folds, wherein four folds come together at a single vertex. The ability of this structure to pack and unpack with a few degrees of freedom leads to their use in deployable structures such as solar sails and maps, just as this feature is useful in insect wings, plant leaves and flowers. We probe the qualitative and quantitative aspects of the mechanical behavior of these structures with a view to optimizing material performance.

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