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Geometry and Mechanics of Chiral Pod Opening[1] ERAN SHARON, SHAHAF ARMON, The Hebrew University of Jerusalem, EFI EFRATI, University of Chicago, RAZ KUPFERMAN, The Hebrew University of Jerusalem — We study the geometry and mechanics that drive the opening of Bauhinia seeds pods. The pod valve wall consists of two fibrous layers oriented at $\pm$ 45° with respect to the pod axis. Upon drying, each of the layers shrinks uniaxially, perpendicularly to the fibers orientation. This active deformation turn the valve into an incompatible sheet with reference saddle-like curvature tensor and a flat (Euclidean) reference metric. These two intrinsic properties are incompatible. The shape is, therefore, selected by a stretching-bending competition. Strips cut from the valve tissue and from synthetic model material adopt various helical configurations. We provide analytical expressions for these configurations in the bending and stretching dominated regimes. Surface measurements show the transition from minimal surfaces (narrow limit) to cylindrical ones (wide limit). Finally, we show how plants use these mechanical principles using different tissue architectures.

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