

Simulating Origami Facet Bending with a N5B8 Bar and Hinge Model

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Abstract

This work presents a simplified bar and hinge model that can simulate the essential behaviors of origami. The model uses five nodes and eight bars for each quadrangular panel, and is thus designated as N5B8. The model can capture stretching and shearing of thin sheet panels; bending of the initially flat panels; and bending along prescribed fold lines. This research explores how the N5B8 approximates facet bending behaviors and how to pick stiffness parameters for this and other bar and hinge model definitions [1-3]. Simulating the stiffness and estimating deformed shapes of origami is important when conceptualizing and designing the origami into practical systems and structures. The simplicity of bar and hinge models makes them well suited for the origami community, and their efficiency makes them suitable for design problems such as optimization and parametrization of geometric origami.

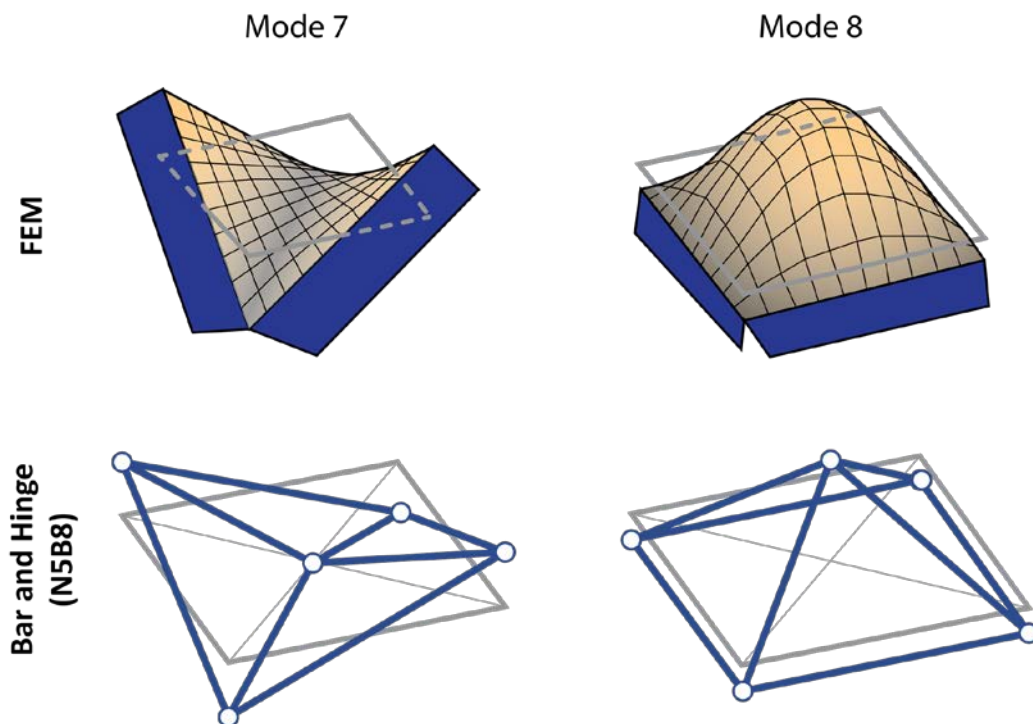


Figure 1: Bending modes of a quadrangular origami panel simulated with a discretized finite element model (top) and the bar and hinge model (bottom). The N5B8 model is capable of capturing two global deformations of a thin panel with restricted edges.

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