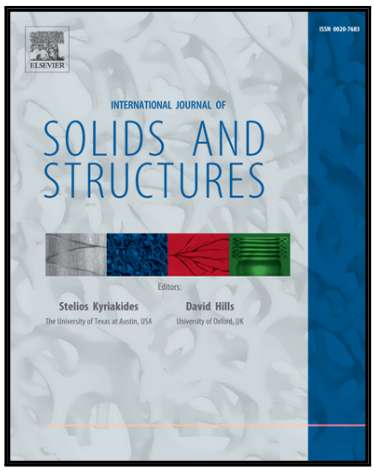

Bar and hinge models for scalable analysis of origami

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Bar and hinge models for scalable analysis of origami

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Dedicated to the memory of William "Bill" McGuire (1920-2013)

Abstract

Thin sheets assembled into three dimensional folding origami can have various applications from reconfigurable architectural structures to metamaterials with tunable properties. Simulating the elastic stiffness and estimating deformed shapes of these systems is important for conceptualizing and designing practical engineering structures. In this paper, we improve, verify, and test a simplified bar and hinge model that can simulate essential behaviors of origami. The model simulates three distinct behaviors: stretching and shearing of thin sheet panels; bending of the initially flat panels; and bending along prescribed fold lines. The model is simple and efficient, yet it can provide realistic representation of stiffness characteristics and deformed shapes of origami structures. The simplicity of this model makes it well suited for the origami engineering community, and its efficiency makes it suitable for design problems such as optimization and parametrization of geometric

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