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# A HIGH-FIDELITY DYNAMIC MODEL FOR ORIGAMI BASED ON ISO-PARAMETRIC ABSOLUTE NODAL COORDINATE FORMULATION (ISO-ANCF)

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Origami-inspired structures and material systems have been used in many engineering applications because of their unique kinematic and mechanical properties induced by folding. However, accurately modeling and analyzing origami folding and the associated mechanical properties are challenging, especially when large deformation and dynamic responses need to be considered. In this paper, we formulate a high-fidelity model—based on the iso-parametric Absolute Nodal Coordinate Formulation (ANCF)—for simulating the dynamic folding behaviors of origami involving large deformation. The center piece of this new model is the characterization of crease deformation. To this end, we model the crease using rotational spring at the nodes. The corresponding folding angle is calculated based on the local surface normal vectors. Compared to the currently popular analytical methods for analyzing origami, such as the rigid-facet and equivalent bar-hinge approach, this new model is more accurate in that it can describe the large crease and facet deformation without imposing many assumptions. Meanwhile, the ANCF based origami model can be more efficient computationally compared to the traditional finite element simulations. Therefore, this new model can lay down the foundation for high-fidelity origami analysis and design that involve mechanics and dynamics.

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