

Single Fold Multi-Layer Origami Axioms and Their Completeness

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The Huzita-Justin Axioms of origami establish a mathematical foundation for creating folds by aligning points and folds on top of each other. The completeness of this set of axioms was established by Lang. However, Lang's formulation is strictly in the ideal plane where folds are instantiated as infinite lines. Further, each axiomatic process only creates a new fold in the plane and does not move any other folds as would happen on a piece of paper. That is, the formulization effectively infers that the paper has been unfolded after every fold.

This paper analyzes origami folds on multiple layers of paper. This requires looking at partial creases and regions of the paper delimited by other creases. That is, when folding across multiple layers of an actual piece of paper, fold lines are not only finite but do not necessarily even traverse the entire piece of paper. Virtually every crease pattern illustrates this. A look at the construction of these partial creases and regions leads to a set of multilayer origami axioms based upon projecting points and creases vertically and horizontally. A proof of completeness is given by extending Lang's approach.