Geometric Folding Algorithms: Linkages, Origami, Polyhedra [DO07]

Updates to Chapter 16, The Tree Method Section 16.8: Universal Molecule

Erik D. Demaine Joseph O'Rourke

January 17, 2026

1 Universal Molecule

(1) Lang's "universal molecule," part of his TREE METHOD, works to fold any convex polygon to any desired uniaxial base. It was extended to work for nonconvex polygons in [BS16].

(2) This extension settles Conjecture 16.8.1, and so proves Theorem 16.6.1 without assuming a convex decomposition.

2 Origamizer

(1) The ORIGAMIZER algorithm, developed over a period of a decade, folds a convex polygon paper to a given polyhedral manifold, so that the folding is watertight, seamless, and an ε-extra folding.

(2) All these terms are defined in [DT17]. (An early, partial version appeared in [Tac09].)

(3) A high-level overview of the algorithm is described in [O'R25, Ch. 10].

(4) See Fig. 1.

References

[BS16] John C. Bowers and Ileana Streinu. Geodesic universal molecules. *Math. Comp. Sci.*, 10(1):115–141, 2016.

[DO07] Erik D. Demaine and Joseph O'Rourke. *Geometric Folding Algorithms: Linkages, Origami, Polyhedra*. Cambridge University Press, 2007.

Figure 1: Stanford Bunny model of 374 triangles folded by the ORIGAMIZER algorithm. Fig. 1a in [DT17].

[DT17] Erik D. Demaine and Tomohiro Tachi. Origamizer: A practical algorithm for folding any polyhedron. In *33rd Internat. Symp. Comput. Geom.* Schloss Dagstuhl-Leibniz-Zentrum für Informatik, 2017.

[O'R25] Joseph O'Rourke. *The Mathematics of Origami.* Cambridge Univ. Press, 2025.

[Tac09] Tomohiro Tachi. Origamizing polyhedral surfaces. *IEEE Trans. Vis. Comp. Graphics*, 16(2):298–311, 2009.