One String to Pull Them All: Fast Assembly of Curved Structures from Flat Auxetic Linkages

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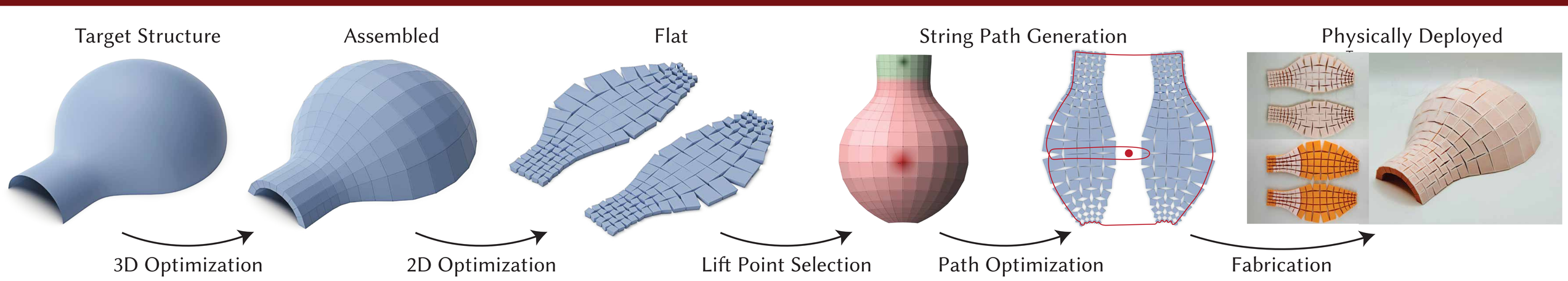
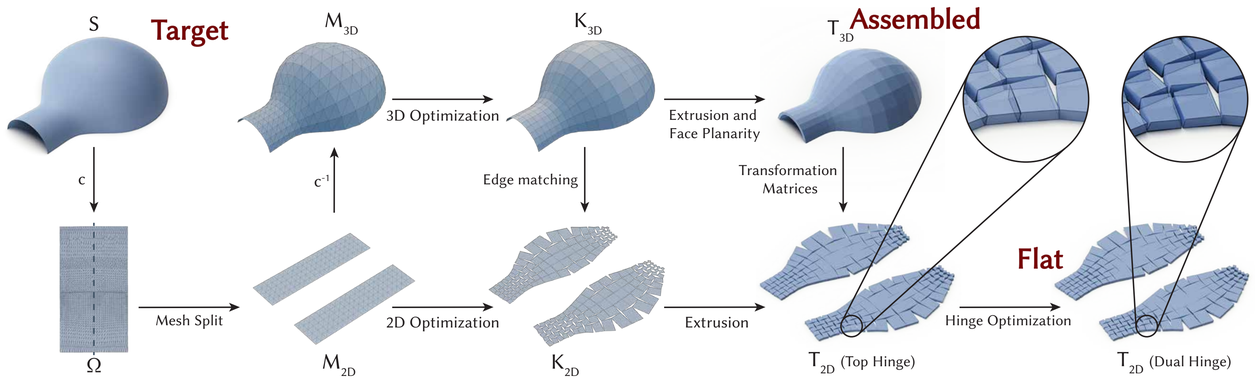
Algorithmic Design Group

Project Website



Surface Rationalization



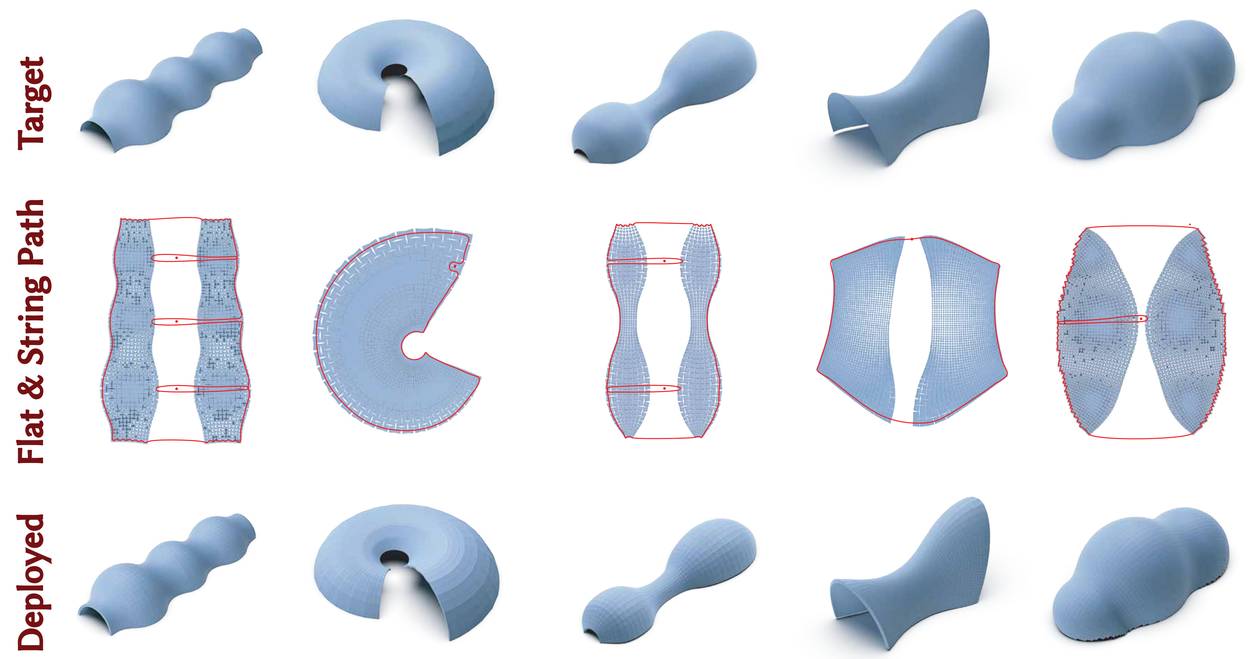
String Path Generation

Constraining Boundary Tiles

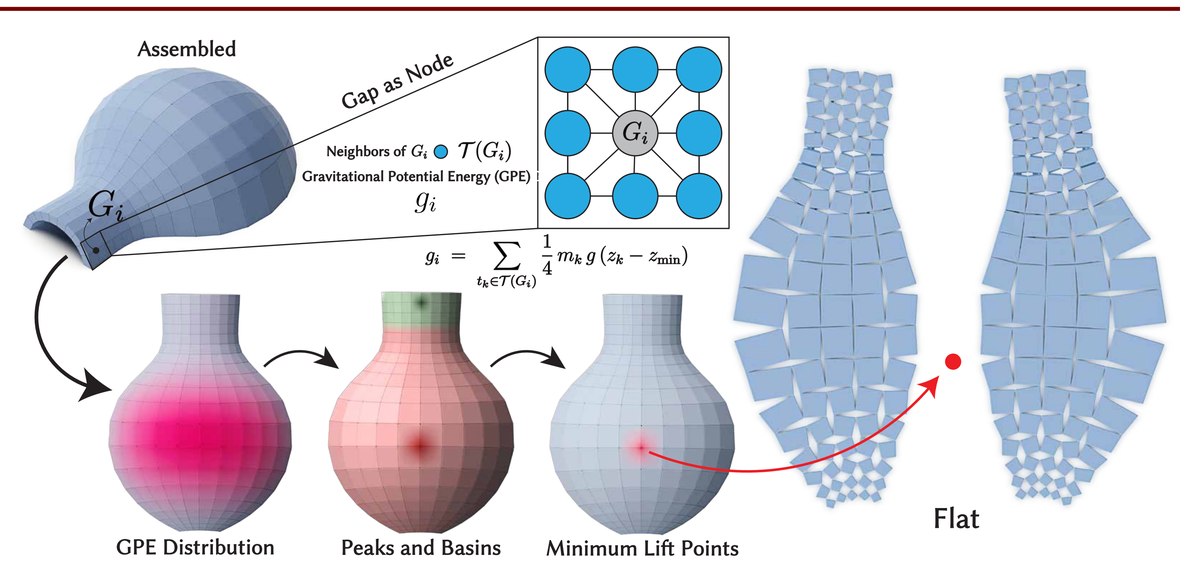
Theorem: A linkage formed of eight-vertex quadrilateral frustum rigid tiles in R^3, each joined to its neighbors at a single corner and arranged so that every interior void is a four-vertex rhomboid, when enclosed by and tensioned with a single continuous boundary string, is isostatic, admitting exactly the six trivial rigid-body motions and no internal infinitesimal flexes.

See Proof in [1]

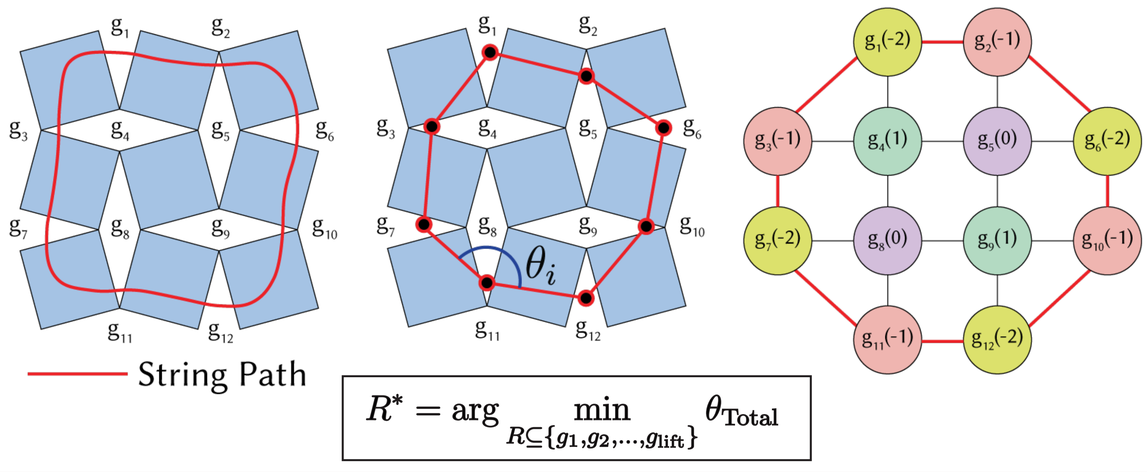
Diverse Doubly Curved Surface Approximation



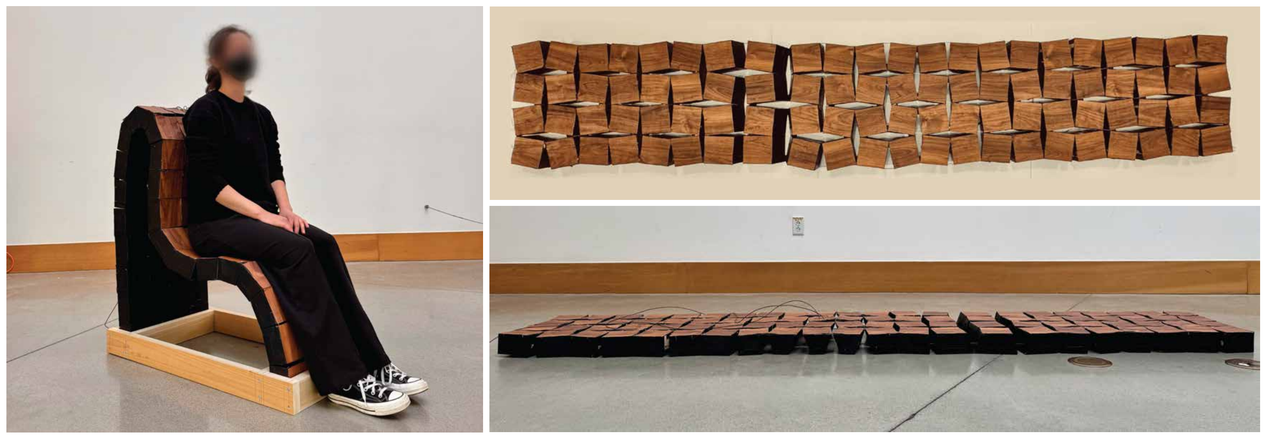
Minimum Lift Points



Friction Minimization



Scale and Fabrication independent Method

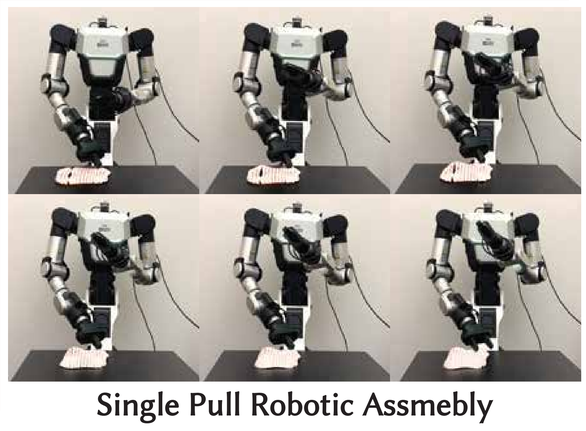


Applications

Personalized Medical Devices

Modular Space Shelters

Architectural Structures



Single Pull Robotic Assmebly

Reference

[1] Akib Zaman, Jacqueline Aslarus, Jiaji Li, Stefanie Mueller, and Mina Konaković Luković. 2025. One String to Pull Them All: Fast Assembly of Curved Structures from Flat Auxetic Linkages. ACM Trans. Graph. 44, 6 (December 2025)

Acknowledgement

We are grateful to Pavle Konaković for his help with design, modeling and rendering. We thank Ryan Mei and Aylin Baca for their generous help with fabrication. This work was funded by the MIT Research Support Committee Award.