Student Project Proposal

Open-ended deployable linkages with elastic beams

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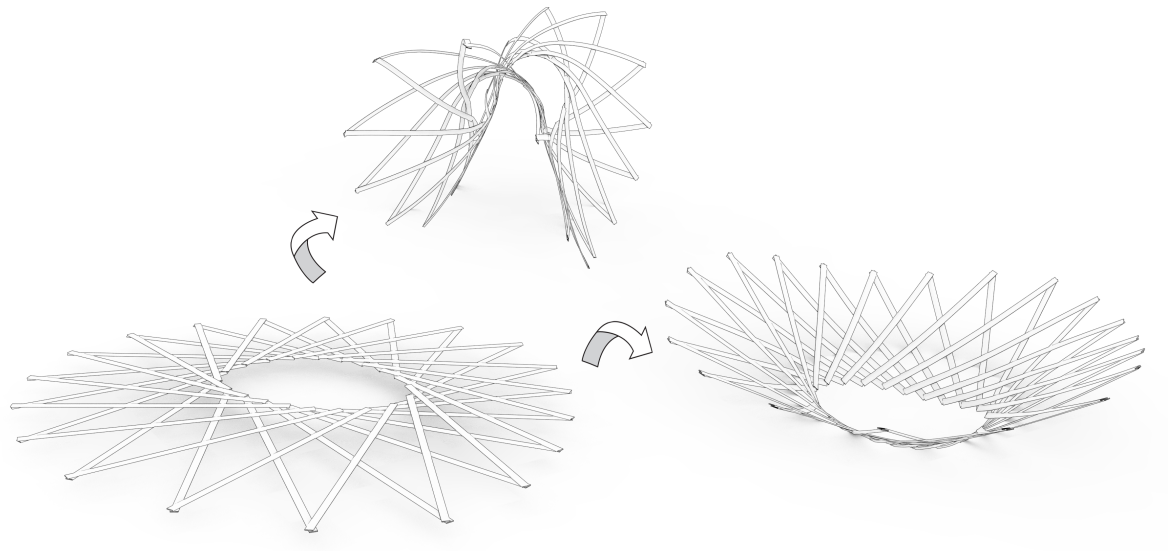

Description

Deployable linkages, as the ones proposed in [1], build on a controlled forming principle in which elastic deformations of flat beams connected using rotational joints are carefully used for inducing 3D curvature and self-stabilizing the material system. Considering that the current work is mainly focused on the exploration of single deployed states, a major opportunity that these linkages offer is the capability to reach multiple equilibrium states by following different deploying paths.

The goal of this project is to address the design space exploration of such linkages with multiple deploying paths by merging the gap between physical and digital models. Efforts will be focused on the combined use of motorized physical prototypes and computational models using our simulation framework to control deployment processes. We are interested in the following topics:

- Physical prototypes. Build motorized actuators for rotational and sliding joints with feedback control.
- Digital twins. Combine digital and physical data to model in real-time the current state of the physical prototype and predict untested states for assessing further transformations.

Prerequisites

The scope of the project can be adapted for semester projects at the bachelor and master level, for one student or two students working as a team, as well as a master thesis project. Basic knowledge of physics-based simulation and at least one programming language is required. Strong background in C++ will be helpful.

References

[1] Panetta, Julian, et al. *X-Shells: a new class of deployable beam structures*, ACM transactions on graphics (TOG) 38.4 (2019). https://doi.org/10.1145/3306346.3323040