

Origloo - Bringing Human-Scale Origamic Structures, Design, and Fabrication to the Architectural Masses

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keywords: architectural design, rigid origami, exhibition pavilion

Abstract

Rigidly foldable structures offer unique solutions to diverse engineering and design problems. Despite their structural and mechanical advantages, their potential in architecture and interior design remains unexploited. Although small-scale folded paper models have been employed in European architectural education since the birth of the modern architecture movement, the design and realization of full-scale origamic structures is still missing from the typical architecture skill set and knowledge base.

This paper presents an architectural workflow to be used for the design and fabrication of rigidly flat-foldable, human-scale interior structures. The methodology we propose fills the gap between the level of knowledge in the field of origami-related research and the current inability of architects and designers to use pleated structures in real-life, day-to-day practice.

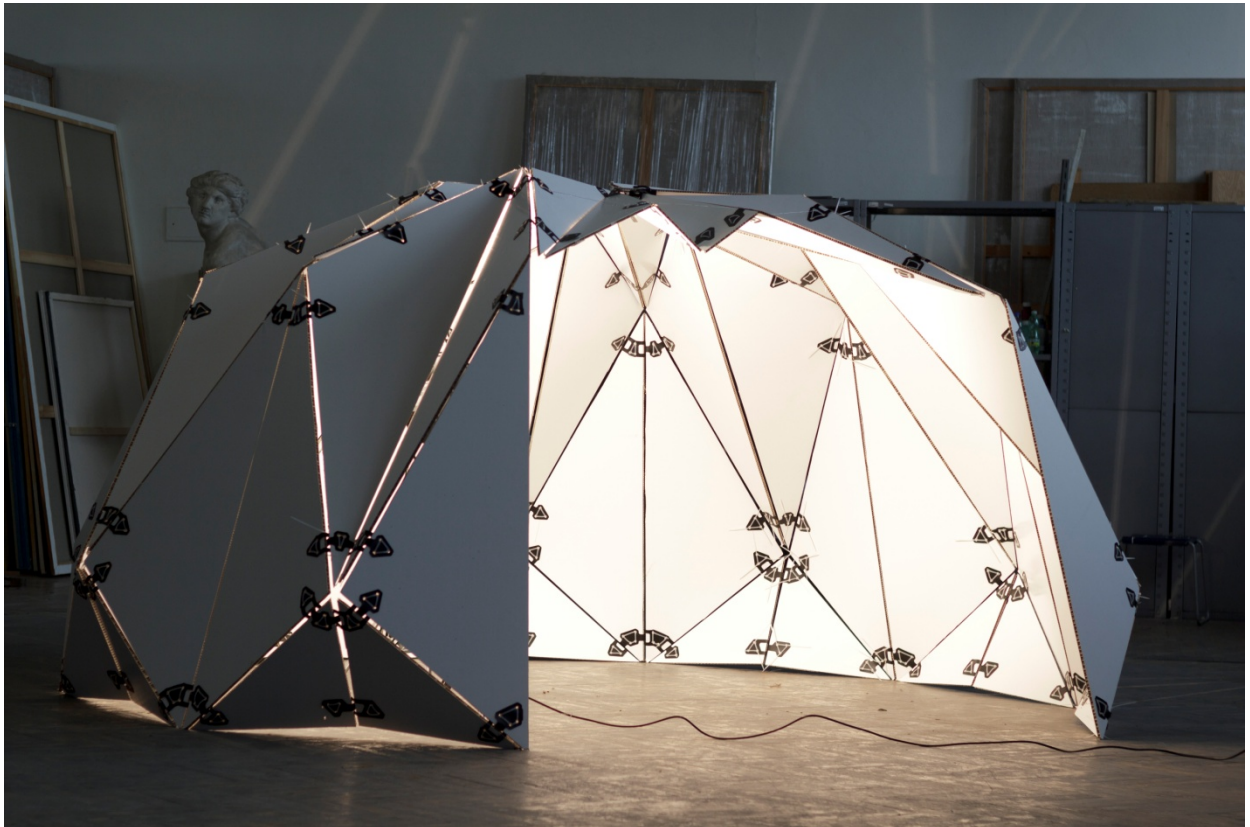


Figure 1: Origloo Interior Pavilion. Photo: Jiří Palacký.

We demonstrate the process on a research-by-design case study of a self-bearing, indoor pavilion made from 10 mm thick honeycomb paper panels linked by polypropylene joints. The entire modular structure is composed of ten repeating radial ribs, and the whole surface is flat-foldable to allow for convenient storage and transportation. It was originally constructed during an international workshop by students who had no prior experience with origami-inspired design.

Our process enables designers to create a physical representation of their concept in a series of small-scale paper models and then develop these further by hand as well as in the virtual environment while keeping full creative control over the design. The use of well-known design steps and graphic user interface tools make this workflow usable for creative professionals with only a basic understanding of the mathematical concepts necessary to solve origami-related problems. We also show an economically feasible and mid-tech method of physical fabrication for a foldable structure.

By using the set of user-friendly tools and methods provided in this paper, any designer possessed of basic spatial imagination can design and fabricate human-scale, origami-inspired structures.



Figure 2: Lightweight, flat-foldable, and cost-effective - origamic structures boast a variety of advantageous properties for exhibition and interior design. Photo: Jiří Palacký.