

Lens Tessellation Inspired Surface Approximation

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Abstract

This paper presents the research on variations and interpretations of David Hufmanns lens tessellation pattern [1], in order to investigate its architectural, spatial and structural properties. Based on the investigations by Demaine et. al. [2] as well as Mr Koschitz [3]work, this contribution is focused on the architectural potentials of Hufmanns work. The authors will present a strategy that allows the generation of different tessellations as spatial patterns on a given quadrilateral mesh surface. These target mesh surfaces either can be single- or double curved. Based on the boundary curves and the neighbouring faces, each mesh face can be represented by a lens and two triangulated segments.



Figure 1: a lens tessellated arch in plywood

The spatial patterns consist of either individually foldable cells, a series of them or entire foldable sheets. Therefore, we name the strategy inspired. As one aim of the investigation is the structural and spatial use in an architectural scale, this “inspirational” approach is not a limit to the strategy as sheet materials are always limited in size by its fabrication constraints.

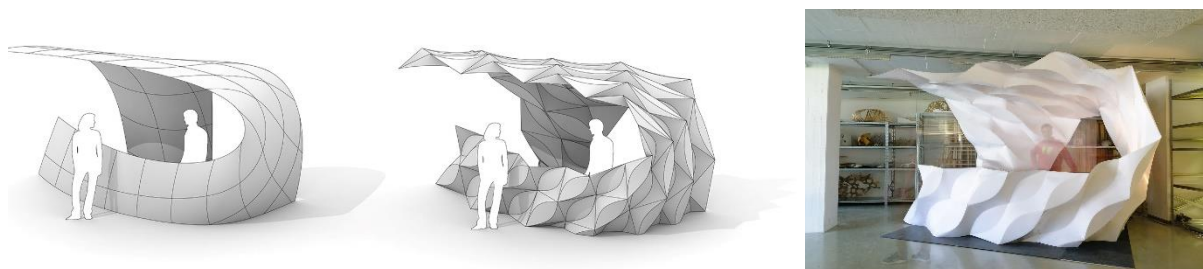


Figure 2: the Lens Tessellation Bar as the first applied large-scale demonstrator

The structural and spatial qualities were also investigated with several demonstrators in various scales and materials. In this paper the focus will lie on the first ever build demonstrator entitled the lens-tessellation bar. This project shows the potential of the strategy as well as its problems. Assembled from 300g Paper sheets, folded to unique lenses and assembled to a three dimensional structure, this bar is the first object in a series of large scale demonstrators exploring the potential in an architectural scale

Bibliography

- [1] R. D. Koschitz, Computational design with curved creases : David Huffman's approach to paperfolding, M. I. o. T. D. o. Architecture., Hrsg., Cambridge: PHD Massachusetts Institute of Technology. Department of Architecture., 2014.
- [2] D. Koschitz, „Designing with curved creases,“ in *Advances in Architectural Geometry 2016*, H. E. Z. vdf, Hrsg., Zurich, vdf, Hochschulverlag,AG ETH Zürich, 2016, pp. 82-103.
- [3] D. E. Demaine, L. M. Demaine, A. D. Huffman, D. Koschitz und T. Tachi, „CHARACTERIZATION OF CURVED CREASES AND RULINGS : DESIGN AND ANALYSIS OF LENS TESSELLATIONS,“ in *Origami 6 ; Proceedings of the 6th International Meeting on Origami in Science, Mathematics and Education*, American Mathematical Society, 2016, pp. 209-230.