

A designing method for axial symmetrical curved origami with triangular prism protrusions

Submission categories: Mathematics, Design

Author(s) full name(s): Jun Mitani

Institutional affiliation(s): University of Tsukuba

Corresponding author: Jun Mitani

Email address: mitani@cs.tsukuba.ac.jp

Postal address: Tennodai 1-1-1, Tsukuba, 305-8573, Ibaraki, Japan

Telephone: +81.29.853.2333

Fax: +81.29.853.2333

A lot of origami pieces that shape wrapping a 3D polytope had been designed by origami artists in past times. A designing method for origami that wrap an axial symmetrical 3D shape, even which has curved surfaces, was described and discussed by Mitani[1]. In the paper, two types of creations, the conical type and the cylindrical type, were proposed. Both of the types have flaps outside of the axial symmetrical shape (Fig. 1(a)). The flaps are derived from portions of a sheet of paper that are not used to form the target 3D shape, and two sheets of paper are overlapped at each flap.

In this paper, the target shape is an axial symmetrical 3D shape, too. Although the result is almost same with the conical type that is described in [1], the shapes of the flaps are not flat but curved triangular prisms (Fig. 1(b)). These flaps, we call them "protrusions", are seen in Jeannine Mosely's origami piece, "bud". We can say that the proposed method can design *generalized Mosely's bud*.

With our method, the target shape, an axial symmetrical 3D shape which is discretized by rotating an input 2D polyline around an axial by $180/N$ degrees, are unfolded onto 2D plane, then the triangular prisms are placed on the rest of the space. We implemented a system that generates the 3D model and the crease pattern at a time from a single 2D polyline which corresponds to the generating line of an axial symmetrical shape. We evaluated the validity of the method by designing some origami creations.

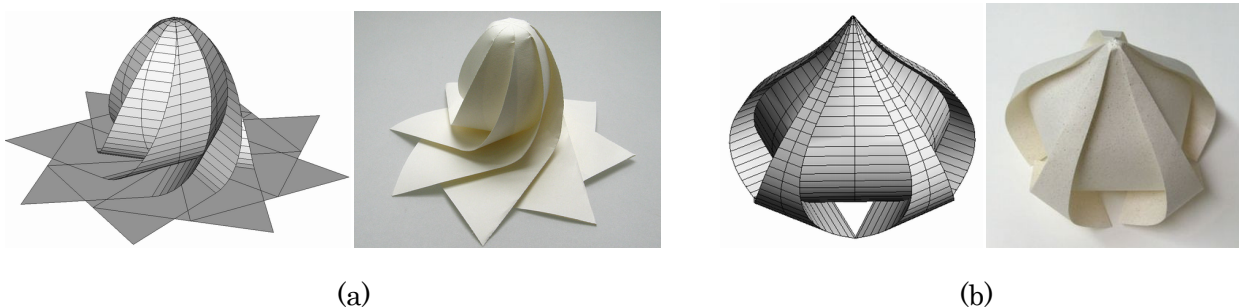


Fig 1. Origami shape designed by using a method proposed by [1] (a), and proposed in this paper (b).

Reference:

[1] Jun Mitani, "A Design Method for 3D Origami Based on Rotational Sweep", Computer-Aided Design and Applications, Vol.6, No.1, pp.69-79, 2009.