

COLUMN-SHAPED ORIGAMI DESIGN BASED ON MIRROR REFLECTIONS

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Origami itself is traditionally enjoyed as art. Meanwhile, the technology of origami, making an object by folding a single sheet of paper, is useful for engineering. As many software programs for designing shapes of origami were developed recently, we can get variety of origami shapes quickly today. The shapes designed with them are, however, limited by their algorithms. Mitani proposed a method for designing three-dimensional origami based on a rotational sweep^[1]. The internal shape of the origami designed with this method is a solid generated with rotational sweep, and gussets were placed on the outside. Mitani and Igarashi proposed an interactive user interface for designing curved origami which has planar curved folds^[2]. The approach is based on the fact that when a part of a developable surface is reflected with a simple mirror operation, the resulted shape is also reconstructable with a single sheet of paper without tearing. In this paper, we propose a system combining advantages of both approaches. On the implemented system, the column-shaped origami pieces with bumps as shown in Fig.1 are designed with a simple user interface. When a user draws the vertical cross-section on a screen, the resulted 3DCG model and the crease pattern (Fig.1 left) are both generated automatically. The user can edit the cross-section and some parameters such as the radius of the column, the number of times of reflections, and the aspect ratio while seeing the 3DCG model and the crease pattern are updated in realtime. The shapes designed with this approach cover not only the shapes of the cylindrical type^[1] but also other variation such as Yoshimura pattern. Further, it is possible to design an origami piece whose horizontal cross-section is not a circle. The proposed approach is more flexible and applicable for wider range of origami pieces which have curved folds.

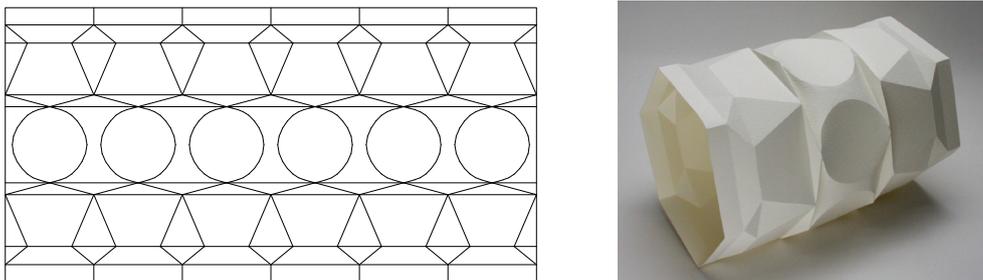


Fig.1 The crease pattern (left), and a photo of the constructed column-shaped origami (right).

Keywords: Origami, Geometry, Mirror reflection

References

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- [2] Jun Mitani, Takeo Igarashi, "Interactive Design of Planar Curved Folding by Reflection", Pacific Conference on Computer Graphics and Applications - Short Papers, pp.77-81, 2011.