THE MODULAR UNITS OF CAD/CAM FABRICATION

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REVIEW

After Frank O'Gehry's completion of the fish sculpture in Barcelona, the technique of CAD/CAM fabrication has gradually matured. Designers could use computer to acquire the freedom of form without most restrictions. Typical CAD/CAM fabrication can precisely capture the sections of 3D (three-dimensional) freeform and output those contours into 2D (two-dimensional) structures by computer assistance (Kolarevic 2001; Groover and Emory 1984). In the procedure, due to the accurate output of frameworks, designers could realize the outlines of complicated forms in a low error way. After making frames, architects have to attach suitable skins on the structures according to different situations of form (Lim 2006). It is a traditional CAD/CAM fabrication which has established for a long time

PROBLEM

However, the procedure has its own drawbacks in two aspects. First, the traditional way of making frames expects the entire framework could be output in one time. Because it can raise the accuracy of manufacture, but current machines are commonly not big enough for the goal. The frames must be divided into several parts to adapt the mechanical limitation of output size and then combine those components into one part again. Unconsciously, the sum of exporting raised and increased the chances of making inaccuracies. Designers have to worry about how to connect different objects into one part which was unexpected. It lost the significant meaning of CAD/CAM fabrication.

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Second, due to the division of frameworks, the whole skin has to separate also. Nevertheless, the division is a 2D demarcation that could not capture the curves of 3D skin. Designers can only use stiff 2D skins to simulate vivid 3D curved surface and yield the discrepancy between the imagination and representation. Besides that, the ill-fitting phenomenon will emerge from the 2D skin and curved frames. Making lots of seams and leaking problems. People regard that as an unavoidable problem and turn to focus on these seam issues only. The procedure is a compromised result which is limited by mechanical restrictions. It is a seesaw battle between the accuracy of frames, skins and funds. However, even it could not make the perfect form, somehow designers still depend on the blemished method and get used to its drawbacks. It becomes a limitation of form development.

OBJECTIVE

In order to improve this situation, the research proposes a new CAD/CAM fabrication. Not to separate freeform into frames and skins but divide it by several particles. Like human beings are composed by numerous molecules, through stacking many small units can also approach to various freeform. The main idea is not to produce exactly the imagination form but to fabricate a close representation by modular units.

The chosen unit is deltoidal icositetrahedron. According to the geometry characteristic, it can attach 2D skin to its frames perfectly and avoid making any seams. In the experiment, it can find out that the modular units have some regular way of permutation. Although the regular way can also make various freeform, but it express saw-toothed edges and break the aesthetic of design concepts. In the purpose of improving the setback, the research creates a changeable unit for the saw-toothed edges. The unit can change its angles and transform to the sub-type of deltoidal icositetrahedron without taking any part of it. The sub-type units can perfectly fit to those edges and make the form approach to smooth appearance. It is a way may not realize imagination form perfectly but won't cause any seams and economize on the fund of using big machines. Compared with the traditional CAD/CAM fabrication, it is a potential way to develop.