Volume-based Mesh Editing Using Cylindrical Parameterization (poster0133)

Yohisyuki Furukawa*
National Institute of Advanced Industrial Science and Technology, Japan

Yasuhiro Yoshioka
The University of Tokyo, Japan

Hiroshi Masuda
The University of Tokyo, Japan

1 Introduction

Cut-and-paste editing of free-form surfaces (e.g.[Biermann et al. 2002]) plays an important role for reusing existing 3D models. In this type of editing operations, a 3D model is separated into a base surface and a detail surface. Then, a user cuts the detail surface of the source model, and pastes it to the target model. In most cut-and-paste methods, base and detail surfaces are restricted to shapes which are homeomorphic to disks.

This research aims at solving this topological limitation and expanding the topological domain covered by cut-and-paste editing. In this poster session, we will show a new volumetric parameterization and demonstrate its benefits by examples.

2 Extending volumetric parameterization by cylindrical parameterization

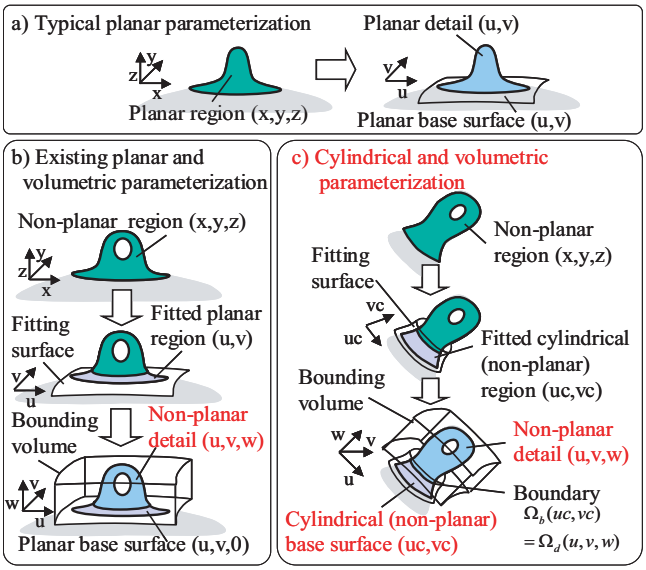

Figure 1: Topological domains covered by parameterization methods in cut-and-paste editing.

Figure 1 shows topological limitations in cut-and-paste editing. Figure 1a) shows a typical cut-and-paste operation, in which the base and detail surfaces must be homeomorphic to disks. In Figure 1b), the detail surface is parameterized in a volume region[Furukawa et al. 2003], and therefore, it can be an arbitrary topological shape. In this method, a volume is generated by optimization so that the base and detail surfaces are continuously connected. This method enables flexible cut-and-paste modeling. However, it also fails to manipulate adequately popular shapes, such as heads and arms, because the base surfaces of these shapes are not planar regions, but cylindrical surfaces, as shown in Figure2.

Figure 1c) shows our new cut-and-paste editing. First, the base surface is parameterized as a cylindrical surface. This parameterization generates constraints of positions and tangent vectors on the boundary Ω_b. Then, a volumetric region is calculated so that one of boundaries of the volume is perpendicular to the cylindrical region. In pasting operation, the deformable volume including the detail is located on the parameterized base surface of the target, and it is deformed according to the constraints of the base surface of the target.

3 Results

Figure 2 shows examples of the cut-and-paste editing operations based on cylindrical and volumetric parameterization. The results show the new parameterization technique can handle the wider topological domain and generate natural shapes.

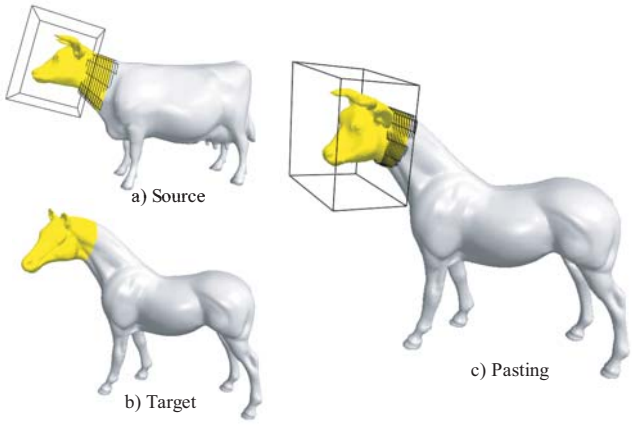

Figure 2: Cut-and-paste example using our method.

References

Biermann, H., Martin, I., Bernardini, F., and Zorin, D. 2002. Cut-and-paste editing of multiresolution surfaces. *ACM Trans. Graph. 21*, 3, 312–321.

Furukawa, Y., Masuda, H., Miura, K. T., and Yamato, H. 2003. Cut-and-paste editing based on constrained b-spline volume fitting. In *Proceedings of Computer Graphics International 2003*, 222–225.

*e-mail: y-furukawa@aist.go.jp