Boolean Operations for Free-form Models Represented in Geometry Images

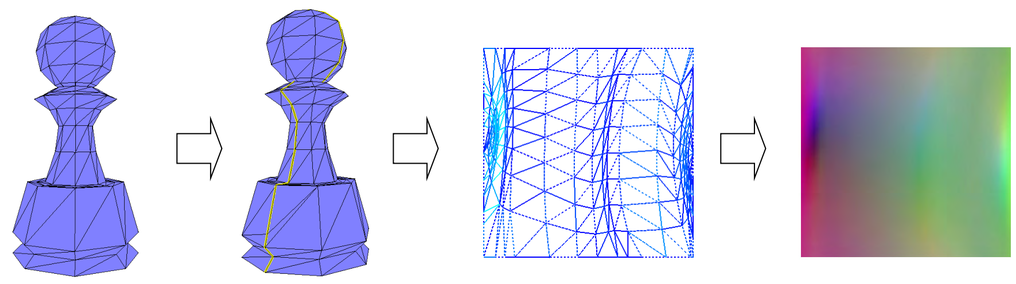
Yan Fu and Bingfeng Zhou, Peking University

Abstract

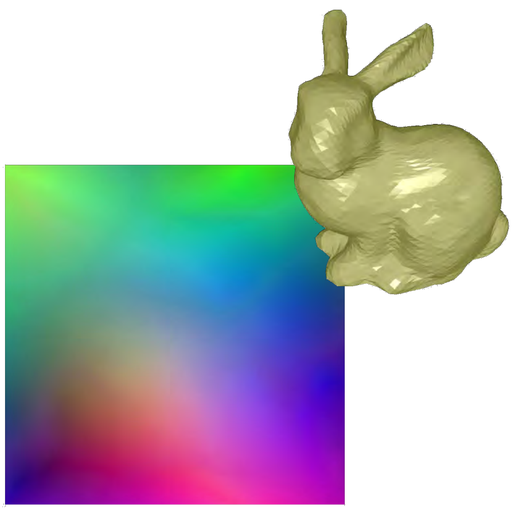
We present a Boolean operation algorithm for free-form solid models represented in geometry images. By taking advantage of the regular data organization of geometry images, our algorithm can perform efficient surface division using boundary-fill algorithm which is previously used for digital image processing. A quadtree subdivision scheme is also applied to the geometry images to accelerate the intersection line calculation. Experimental result shows that the algorithm can generate well-defined closed triangle meshes for Boolean operations. The resulted triangle mesh can also be converted into a geometry image for further processing.

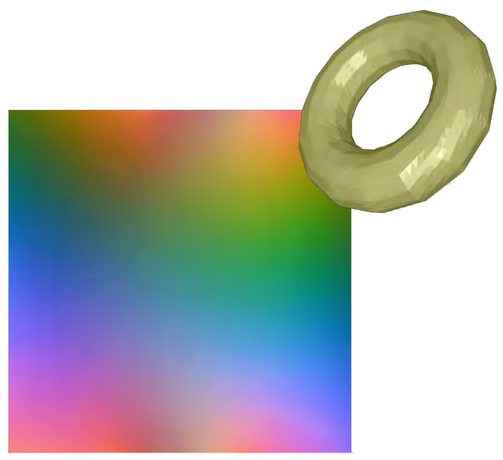
Geometry Image

- ✓ Gu et al., 2002
- ✓ Store the geometry information as (r,g,b) in a 2D image
- ✓ Avoid the storage of connectivity information

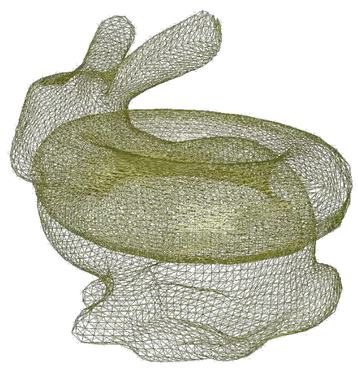


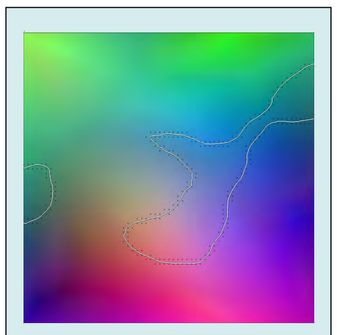
Input geometry images



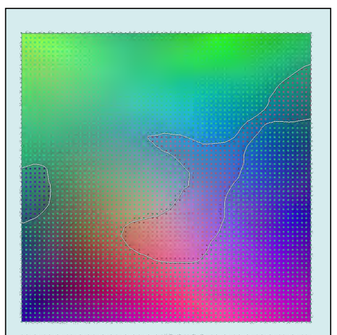


Boolean operation

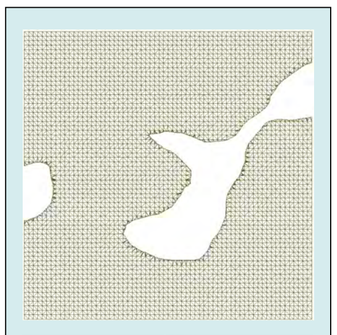




Intersection



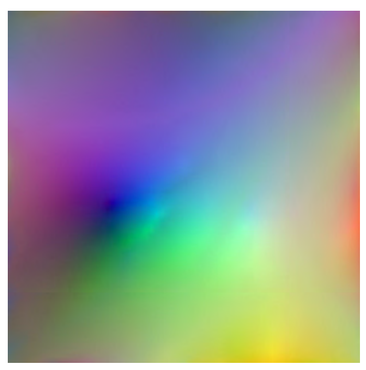
Pixel classification



Triangulation

Resulting model

Resulting mesh model



Converted geometry image

Contribution

- ✓ An efficient Boolean operation method for free-form solid models
- ✓ Accelerated intersection by using hierarchical quadtrees
- ✓ Independent of resolutions of geometry images

Future Works

- ✓ To improve the robustness of inter-section
- ✓ Graphics hardware acceleration

Contact

zhoubingfeng@icst.pku.edu.cn
fengjie@icst.pku.edu.cn