Supplemental Material: Efficient and Robust N-Mesh Boolean Operations Using Hybrid Representations

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1 More Failure Cases of Self-Union Evaluations on Thingi10K

We illustrate more failure cases of self-union tests by Cork [1] and QuickCSG [2]. Cork tends to produce self-intersecting results when encountering coplanar faces, which QuickCSG is more likely to generate open boundary the result meshes (see Fig. 1).

2 Binary Boolean Evaluations on Data Set from [3]

We reproduce the exhaustive tests in [4] on the data set from [3]. The data set contains 26 widely-used models. We conduct pair-wise union, intersection and difference for all 325 pairs. 1300 tests are conducted and 1296 results (4 fail cases) are generated (see Fig. 2 and Fig. 3). All resulting mesh files can be found inside 'binary_test.zip' in the supplemental materials.

References

[1] G. Bernstein. (2013) Cork boolean library. [Online]. Available: https://github.com/gilbo/cork/
[2] M. Douze, J.-S. Franco, and B. Raffin, "Quickcsg: Arbitrary and faster boolean combinations of n solids," Ph.D. dissertation, Inria-Research Centre Grenoble–Rhône-Alpes, 2015.
[3] H. Barki, G. Guennebaud, and S. Foufou, "Exact, robust, and efficient regularized booleans on general 3d meshes," *Computers & Mathematics with Applications*, vol. 70, no. 6, pp. 1235–1254, 2015.
[4] Q. Zhou, E. Grinspun, D. Zorin, and A. Jacobson, "Mesh arrangements for solid geometry," in *Tristate Workshop on Imaging and Graphics Posters*, 2016.

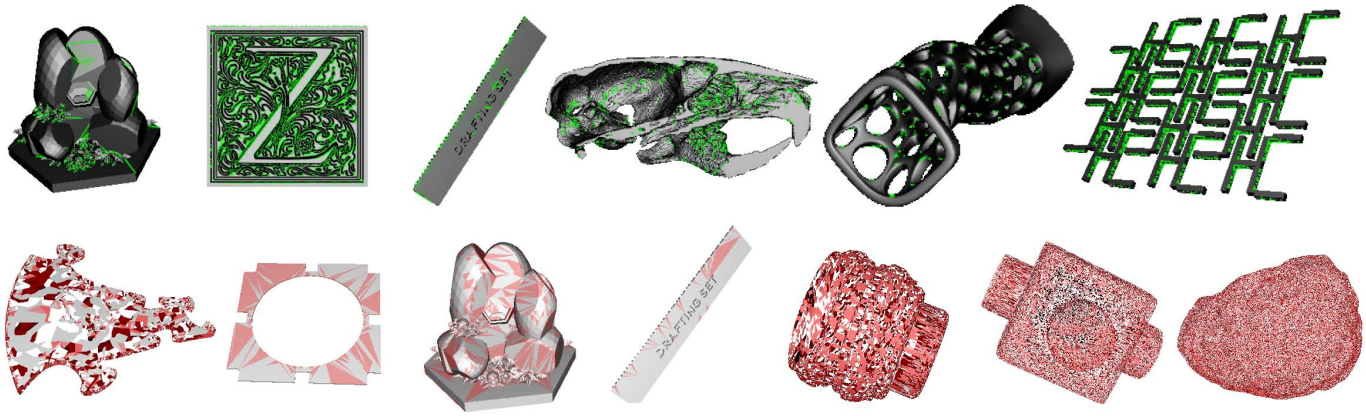

Figure 1. The models on the upper row are the failure cases by QuickCSG. The green line segments are open boundaries. The models on the lower row are the failure cases by Cork. The red faces are self-intersecting faces on the result meshes.

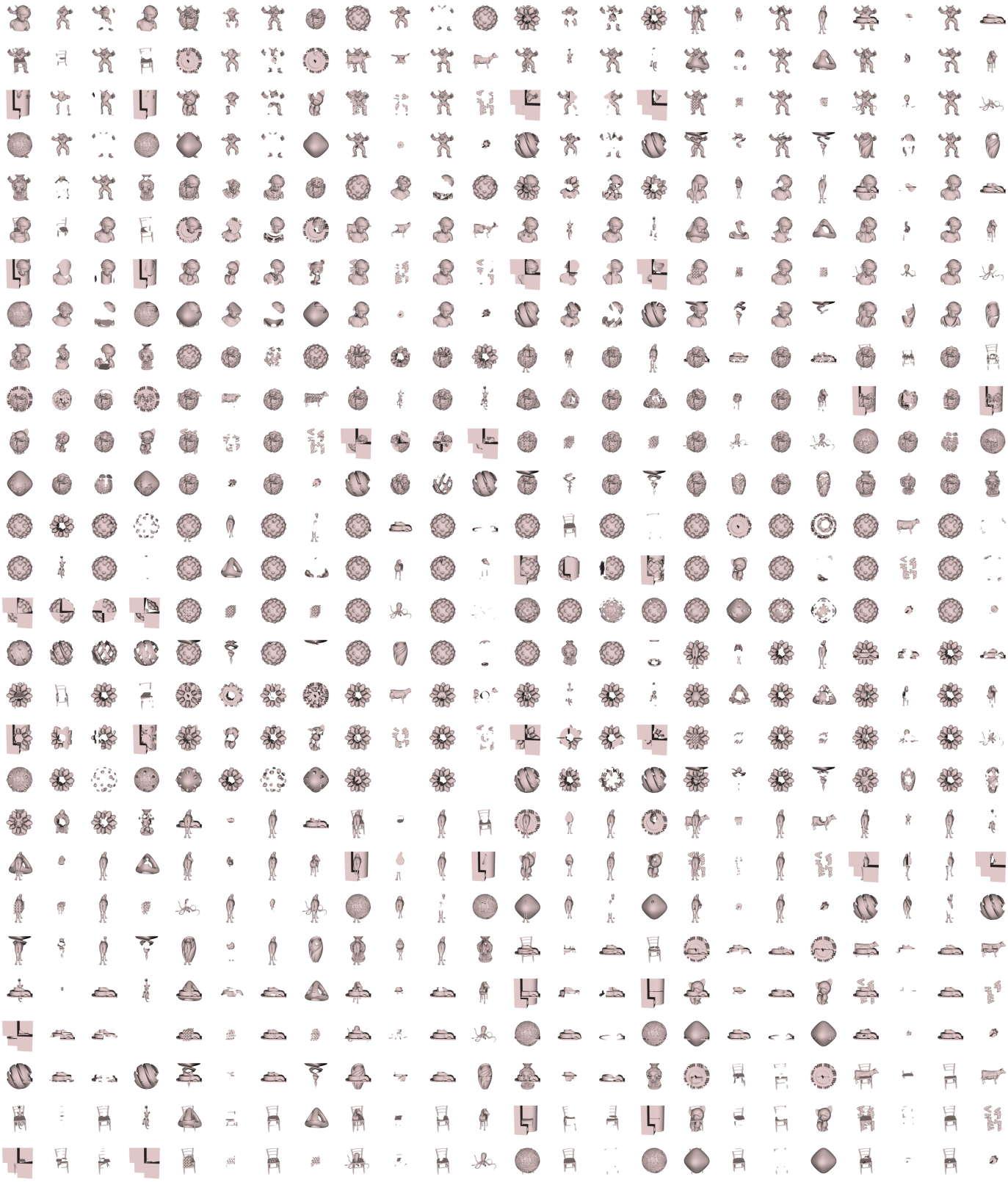

Figure 2. The rendering images of the 1296 mesh files (part 1). It contains the union, intersection and both asymmetric differences of the first 168 mesh pairs.

Figure 3. The rendering images of the 1296 mesh files (part 2). It contains the union, intersection and both asymmetric differences of the last 157 mesh pairs.