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From 3D Meshes to 3D printed figures

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Figure 1: Highlighting the weak parts of the Warrior's model



Figure 2: 3D Print of the Warrior's model

The objective of our work is to make printable digital 3D models used in film and video game industry. For this purpose we are particularly interested in 3D meshes as native representation of the geometry and the appearance, the color and the texture, of the objects. Fixing mesh errors in 3D printing of action figures mostly aims to repair open boundaries, non-planar holes with multi-connected components, and zero-thickness surfaces. We propose a simplified pipeline to transform an OBJ like mesh representation with missing surface orientation into a printable model. Our processing pipeline consists of four steps. First, the input OBJ representation is traversed and each edge is classified according to the number of its neighbour faces. There are three possibilities, an edge is boundary to one face, an edge is boundary to two faces, called manifold-edge, and last, one edge is common to more than two faces, called non-manifold edge. Next, connected components are extracted: two faces belong to the same component only if they have one manifold edge in common. The orientation of each connected component is defined to match to the orientation of the majority of the component faces. For each component, non-manifold vertices are duplicated. Further, mesh boundaries are extracted and classified according to an Indicator of Boundary Contour Classification (IBCC) into two categories : boundaries defining holes to be filled, and

boundaries defining shells to be thickned. Then, open boundaries are repaired according to their IBCC: holes are filled and zero-thickness shells are thickned through offsetting. At this point of the processing pipeline, the input mesh is decomposed into a set of closed volumes with possibly intersecting parts. Finally, geometric intersections are treated “on the flight”. The inclusion intersection tree is computed for each volume intersection region. By means of ray tracing and boundary crossing denumbering, the exterior volume of such region is computed and supplied for printing. Moreover, an object thickness is calculated to emphasize thin regions that can be broken during printing. The resulting models are printable with high degree of fidelity to the designed shapes. The proposed pipeline is implemented and put in production.

Biography

C. Lanterne is a PhD student at Bordeaux University. His research is supported by ANRT, the Association of National Research and Technology, The Industrial Agreements for Training through Research (CIFRE) grant and FabZat SAS Company.

C. Lanterne is a member of the team “Images and Sounds” of LaBRI, Bordeaux Laboratory of Research in Computer Science and the Computer Science Department in charges with tutorials in programming projects in MS degree courses.

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