ABSTRACT

We propose an algorithm for the simplification of three-dimensional shapes that represent real objects, in order to facilitate the construction of wooden or paper models as educational tools or toys. We start from a shape obtained using the classic Marching Cubes algorithm (with the standard 256-configurations Look-Up Table), then we work on the grid which generates the shape using the Look-Up table. We look for some configurations of adjacent signs, we change some signs in these configurations and we modify the local shape accordingly, in order to obtain a shape composed of big planar faces easy to cut on wooden plates or cardboards.

GOAL

Simplify a 3D digital model so that it is easy to build using wood or paper.

HOW

The main idea is to start from a model obtained with the Marching Cubes algorithm and to simplify the shape changing certain signs of the grid. We search all the configurations of adjacent signs (masks of cubes) that we don’t want on the output model and we change some «signs of interests». We used a total of 388 masks.

To make smart sign modifications, we link three data structures: Grid (cubes and signs), Decel (vertices, triangles and half-edges) and Segmentation (charts composed of triangles with the same normal). We change signs of the grid using information given by the segmentation, therefore we have to update all the three data structures every move.

The algorithm allows the user to choose the level of detail of the output model simply by setting the length of the edge of the grid (examples shown on results).