Wire Modeling

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Modeling shapes that are made from wires and solids with large number of holes is an interesting research problem in computer graphics. These shapes are common in art, such as Escher's drawings of rind shapes, and the intricate nested carved sculptures of the Far East. Figure 1 is such an example of the highly decorative architectural embelishments used widely in Indian architecture. Note that this door is made from stone and has a visible thickness.

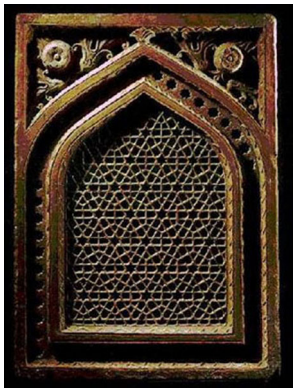

Figure 1: An example of a solid shape with large number of holes.

Figure 2: Wired caricature of Humphrey Bogart.

Unfortunately, most existing modeling programs do not allow the users to easily create such beautiful structures, which we simply call wired shapes. Many modeling programs allow to render wireframes that can be used to give an illusion of wires, but wireframes are not 3d meshes hence lack the depth and richness of a 3d model. Most existing programs also support texture mapping with transparency. Since the transparent texture maps can be very flexible, they are commonly used in computer graphics. However, again they lack depth and do not automatically respond to the 3D environment that they are created in, i.e. in terms of lighting (specularity, shadows etc.) There exist biological visualization programs that can create a 3D wire look. However, their application is strictly restricted to protein modeling and they are not easily used for artistic purposes.

For our purposes, we extended capabilities of our existing topological mesh modeler to create wired shapes (For more information on topological mesh modeling see [1]). This simple extension allows us to replace each edge of a given mesh with a *"3D pipe"*. Moreover, our system guarantees that the pipes are connected and the resulting shape can be physically constructed.

We have developed a variety of remeshing algorithms to create artistically interesting mesh structures from any give mesh. Our remeshing algorithms include not only well-known remeshing schemes (i.e. subdivision schemes such as vertex-insertion, corner-cutting, and simplex; and classical polyhedral operators such as dual, stellation, and truncation), but also the new schemes we have developed. One example of the new schemes is honeycomb algorithm that changes majority of the faces to hexagons and creates a honeycomb look. We can create a wide variety of mesh structures by applying several combinations of remeshing schemes (For an example see Figure 3).

Figure 3: Wired rabbit.

References

[1] http://www-viz.tamu.edu/faculty/ergun/topology

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