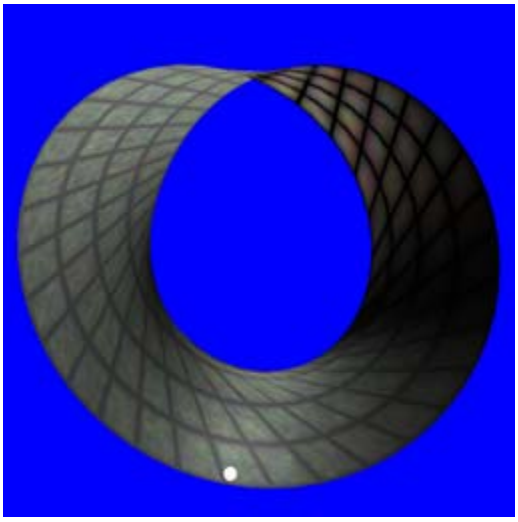
Technical Report

Two-Sided Polygons



DEVELOPMENT

Two-Sided Polygons

This project demonstrates how to correctly light a ribbon object, meaning an object where the front and back sides of each triangle are visible. Such objects are rendered without backface culling and are useful for foliage, banners, cloth, and hair. The problem with lighting such objects in a fixed-function pipeline is that each vertex contains only a single vertex normal. This normal cannot be used to shade both potentially visible sides of each triangle. Fortunately, a simple programmable vertex shader allows us to flip the direction of the normal vector depending on the viewer's position relative to each vertex. No preprocessing or additional data for the mesh is needed to correctly light the ribbon objects from any point of view.

The demo also presents a simple technique to render the two-sided polygons with a translucent effect, like you would see with light shining behind leaves or a lampshade. The translucent effect is easy for thin objects, and is accomplished by providing two textures for the object. The first texture represents the ordinary diffuse light reflected to the viewer. The additional texture is painted to represent the light transmitted through the thin object by lights behind it. The diffuse color texture is used when the light is on the same side of the object as the viewer, and the traslucent transmission texture is used when the light is behind the object. A vertex shader computes a blend factor between the two textures depending on the light position relative to each vertex.

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