

Homework 2

Compute some basic topologic and geometric properties on triangle meshes using half-edge data structure. Improve the OpenGL GUI developed in HW 1.

1. Include the halfedge data structure into hw-1 GUI. Now, instead of reading the .OBJ mesh file, we will directly use ReadMFile() function to read the .M meshes. But you need to revise the Render_Mesh() function for the mesh rendering (20pts).
2. Implement the ComputeNormals() function to compute the normal vector on each vertex. The vertex normal is a weighted average of normal vectors of this vertex's surrounding face,

$$N(v) = \frac{\sum_{f_i \in NbrF(v)} \alpha_i N(f_i)}{\sum_{f_i \in NbrF(v)} \alpha_i}$$

where $NbrF(v)$ is the set of incident faces surrounding the vertex, and the weight α_i is the interior angle of the triangle at this vertex. Use keyboard "f" and "v" to set the normal to be face normal or vertex normal. (25pts)

3. Compute the connected-component number c and boundary loop number b . If $c=1$, compute its genus number g . Print these numbers on the screen (30pts).
4. Compute the Gaussian curvature κ_G on each vertex. Color-encode the surface: color the vertices whose curvature $\kappa_G < -0.05$ to be dark green: ($r = 0, g = 0.5, b = 0$), the vertices whose curvature $\kappa_G > 0.05$ to be dark red ($r = 0.5, g = 0, b = 0$), and all the other vertices to be gray ($r = 0.7, g = 0.7, b = 0.7$). Display/undisplay these color when the key "k" is pressed. (25pts)

Please write all your codes in your "hw2.cpp" file (do not modify the files from the meshlib) and send the hw2.cpp to me. I will compile it with the meshlib files on my computer.