

COSC422 Advanced Computer Graphics
Programming Exercise 03
Surface Approximation

Mesh models generally represent an approximation of three-dimensional surfaces. For example, a tetrahedron, a cube, and an icosahedron are all approximations of a sphere with 4, 6, 20 faces respectively.

The program `IcosahedronDraw.cpp` generates the display of a wireframe model of an icosahedron (Fig. 1). The vertex and face definitions are stored in the file `Icosahedron.h`.

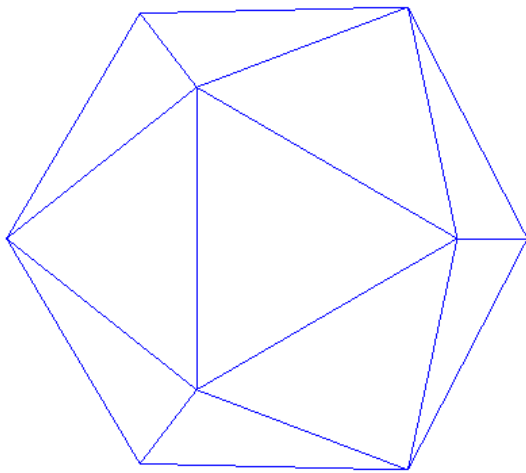


Fig. 1

Modify the program to output patches instead of triangles.

```
glDrawElements(GL_PATHCES, ...)
```

Also, specify the number of vertices in each patch:

```
glPatchParameteri(GL_PATCH_VERTICES, 3);
```

Set the default tessellation level to 4:

```
GLfloat outLevel[4] = {4, 4, 4, 0};
```

```
GLfloat inLevel[2] = {4, 0};
```

```
glPatchParameteri(GL_PATCH_VERTICES, 3);
```

```
glPatchParameterfv(GL_PATCH_DEFAULT_OUTER_LEVEL, outLevel);
```

```
glPatchParameterfv(GL_PATCH_DEFAULT_INNER_LEVEL, inLevel);
```

Create a tessellation evaluation shader to tessellate each triangular patch (Slide [1]-37).

The output should now look similar to that given in Fig. 2.

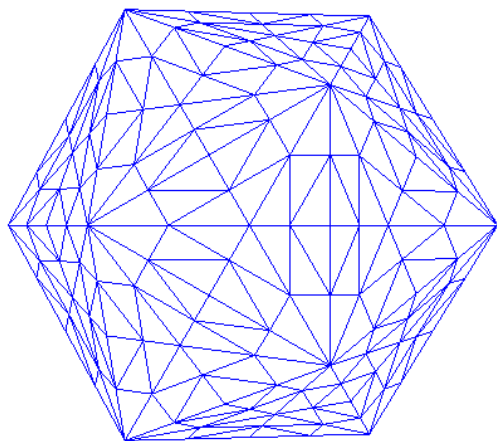


Fig. 2.

The tessellation creates a planar subdivision of each triangle. We will now move each mesh vertex to the surface of the unit sphere (Fig. 3) to generate a closer approximation of the sphere.



Fig. 3.

Modify the mesh vertex position inside the tessellation evaluation shader so that its distance from the centre (origin) is 1 unit. The output should change to the shape shown in Fig. 4.

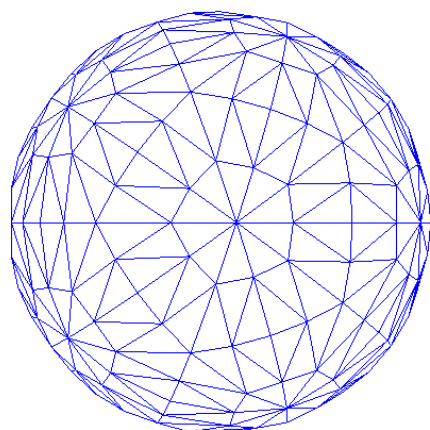


Fig. 4.

[1]: COSC422 Lecture slides, “1 Introduction:OpenGL4”.