Lighting and Shading (Assignment - 04)

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Abstract

Render a sphere and implement Gouraud shading and phong shading.

1 Modelling a Sphere

Lets say r, u, v be the spherical coordinates of the sphere so cartesian coordinates be the following:

x = r cosv sinv

y = r sinu sinv

z = r cosv

Sphere is modelled as a collection of quads where cartesian coordinates for (u, v), (u+1, v), (u+1, v+1), (u, v+1) are computed and are treated as vertices of the quad.

2 Gouraud Shading

1. Ambient shading: In this light colour is multiplied with the ambient strength and the resulting light colour is multiplied by the object colour thus producing ambient effect
2. Diffuse shading: We already have precomputed normals and we compute a new vector called lightDir using vVrertex and lightPos vector and dot it with normal of the vertex. Dot value is the diffuse strength and we multiply it with light colour and then multiply with object colour.
3. Ambient Shading: We find the reflection between normal and lightDir vector computed previously and then dot it with view direction vector computed using vVertex and eye position.
4. (ambient_component + diffuse_component + ambient_component) * objectColour is the resulting colour.
5. All the above computations are done in vertex shader. Due to interpolation in fragment shader specular highlight is a little dim than expected.

3 Phong Shading

1. Ambient shading: In this light colour is multiplied with the ambient strength and the resulting light colour is multiplied by the object colour thus producing ambient effect
2. Diffuse shading: We already have precomputed normals and we compute a new vector called lightDir using vVrertex and lightPos vector and dot it with normal of the vertex. Dot value is the diffuse strength and we multiply it with light colour and then multiply with object colour.
3. Ambient Shading: We find the reflection between normal and lightDir vector computed previously and then dot it with view direction vector computed using vVertex and eye position.
4. (ambient_component + diffuse_component + ambient_component) * objectColour is the resulting colour.
5. All the above computations are done in fragment shader. This time specular highlight is sharper because by shifting all the computation to fragment shader we have avoided linear interpolation of colour happening earlier in gouraud shading.

5 Multiple Lights

When Object colour for both light sources are calculated. Resulting object colours are simply added together to get the effect of multiple lighting. Phong shading is used for this purpose.

3 Compilation Instructions

- Clone the Assignment04_code directory to the desired location on your system.
- Open the terminal and cd into the Assignment04_code directory
- execute **make** command
- execute **./assignment03** command
- window will pop up with a cube. Trackball mode is default.

References

SHADER UTILITY CLASS (USED FOR READING SHADERS FROM A FILE AND CREATING SHADER PROGRAMS)

http://learnopengl.com/code_viewer.php?type=header&code=shader

http://learnopengl.com/#!Getting-started/Camera

HTTP://LEARNOPENGL.COM/#!LIGHTING/BASIC-LIGHTING

SCREENSHOTS

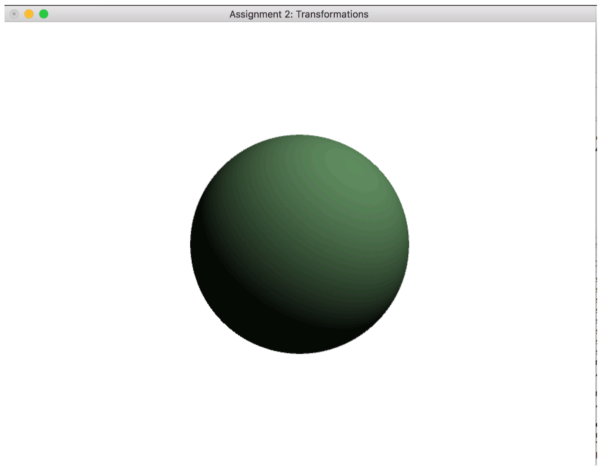


FIGURE 1 - AMBIENT AND DIFFUSE

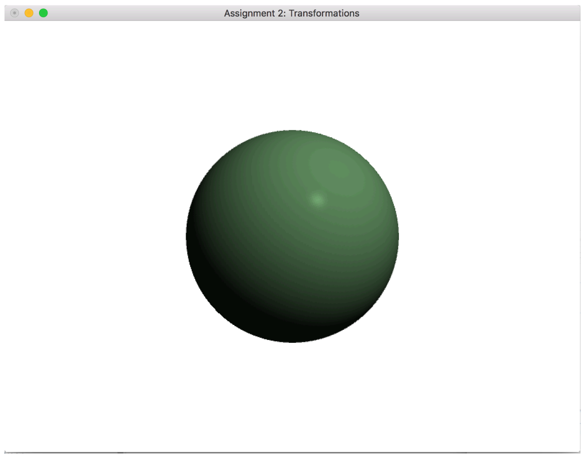


FIGURE 2 : AMBIENT, DIFFUSE, SPECULAR (GOURAUD SHADING)

FIGURE 3 - PHONG SHADING (BELOW)

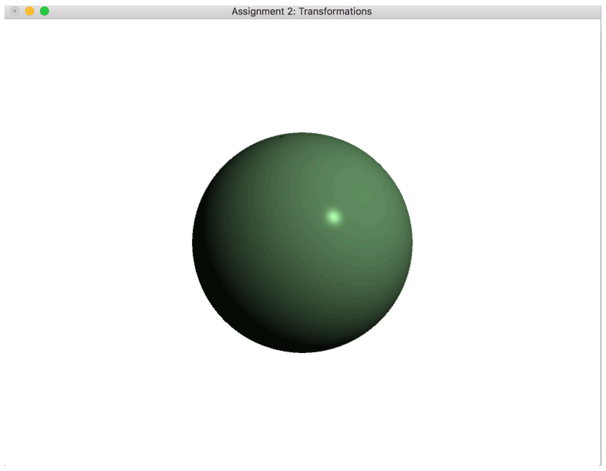
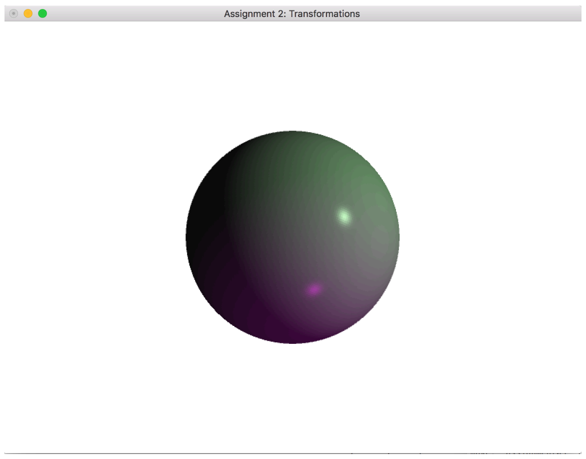


FIGURE 4 - MULTIPLE LIGHTS (BELOW)


Assignment 2: Transformations