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Assessment ADGP 201 - Graphics

Graphics Assessment Documentation for “Direct Lighting”

Purpose:

Introduce the steps needed to implement diffuse, ambient and specular lighting and understand the difference between phong and blinn-phong models.

Learning Outcomes:

- 1) Diffuse implementation with pictures/documentation.
- 2) Ambient implementation with pictures/documentation.
- 3) Specular implementation with pictures/documentation.
- 4) Understand difference between blinn-phong and phong.

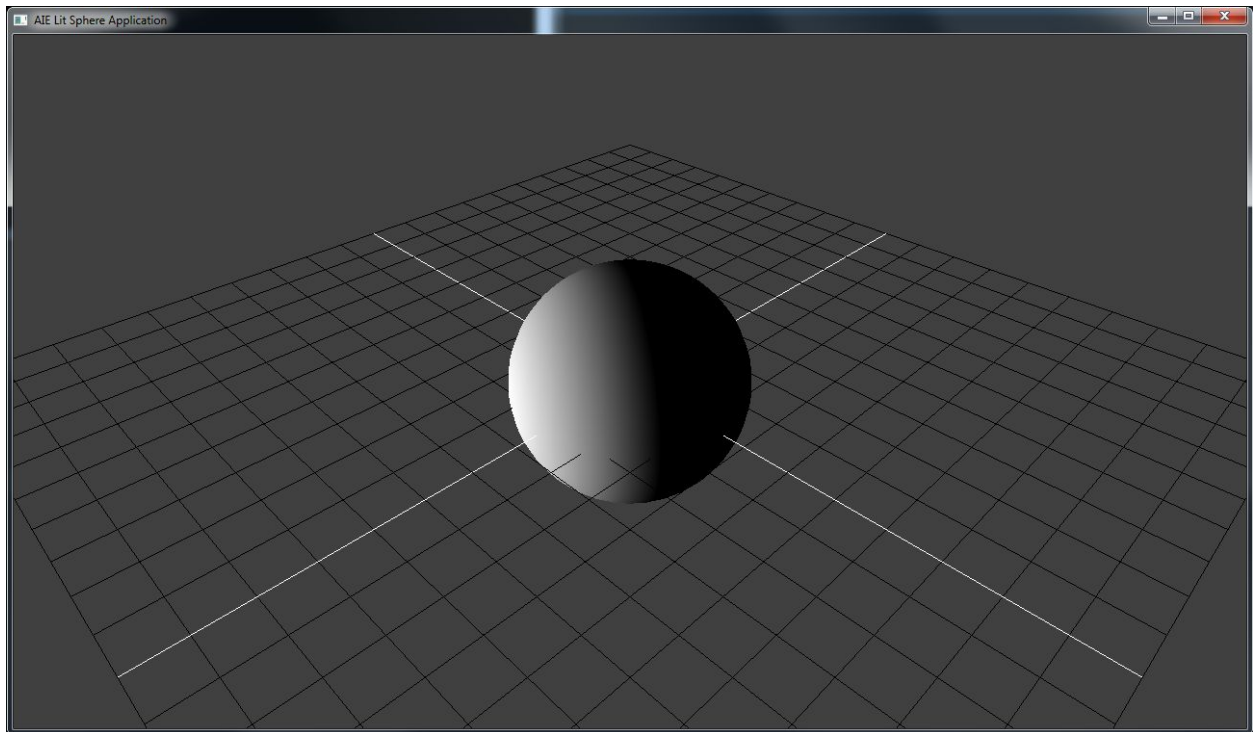
Evidence:

Diffuse: Color of the reflected light is reflected in such a way that the light is reflected at many angles. The equation to calculate diffuse lighting is as follows: $K_d * I_d * \text{lambertTerm}$.

-**K** refers to the surface's material property colors. **d** refers to what light model is being used.

-**I** refers to the light properties. **d** refers to what light model is being used.

-**lambertTerm** is the dot product between the surface's normal vector (**N**) and a vector in the direction the light is coming from (**Lm**). This result is then clamped between zero and one.



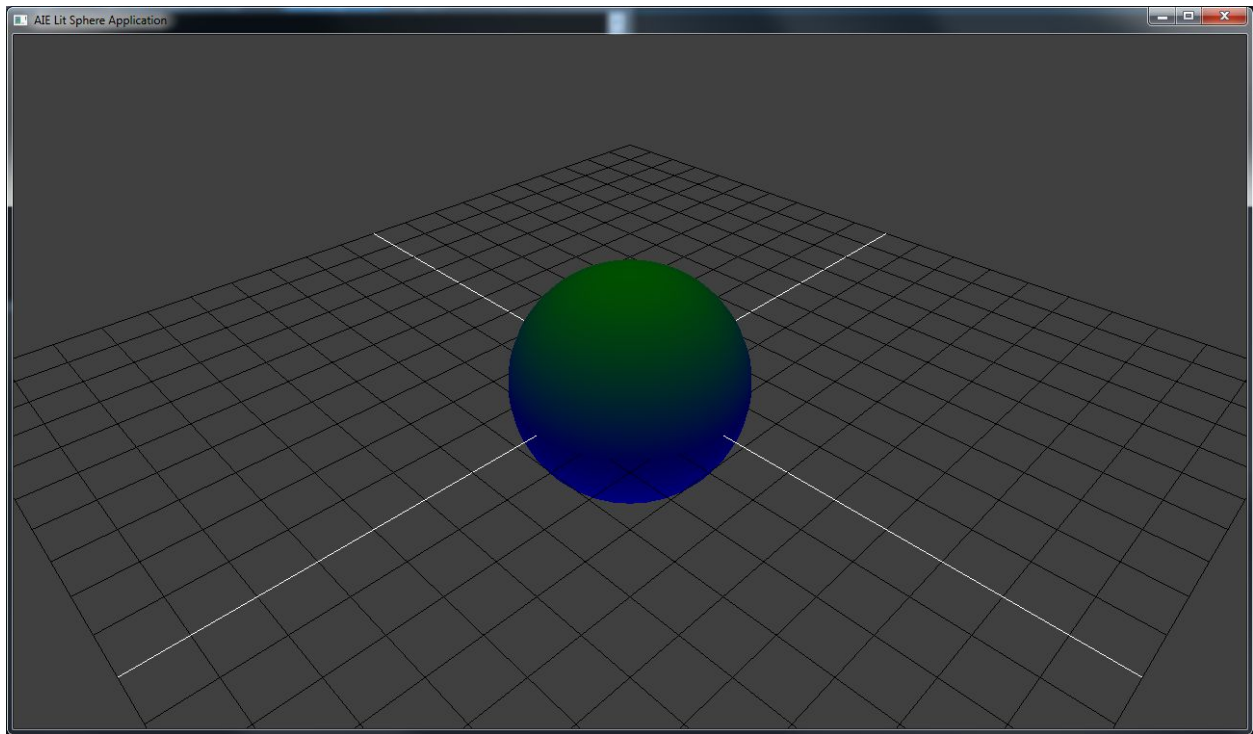
*Picture of diffuse lighting using a sphere.

Ambient: Color of the indirect light in an area. The equation to calculate Ambient lighting is as follows: $(I_a * .01f) * (K_a) * \text{hemisphere}$.

-**K** refers to the surface's material property colors. **a** refers to what light model is being used.

-**I** refers to the light properties. **a** refers to what light model is being used.

-**hemisphere** variable holds the interpolate colors from upper and lower hemispheres.



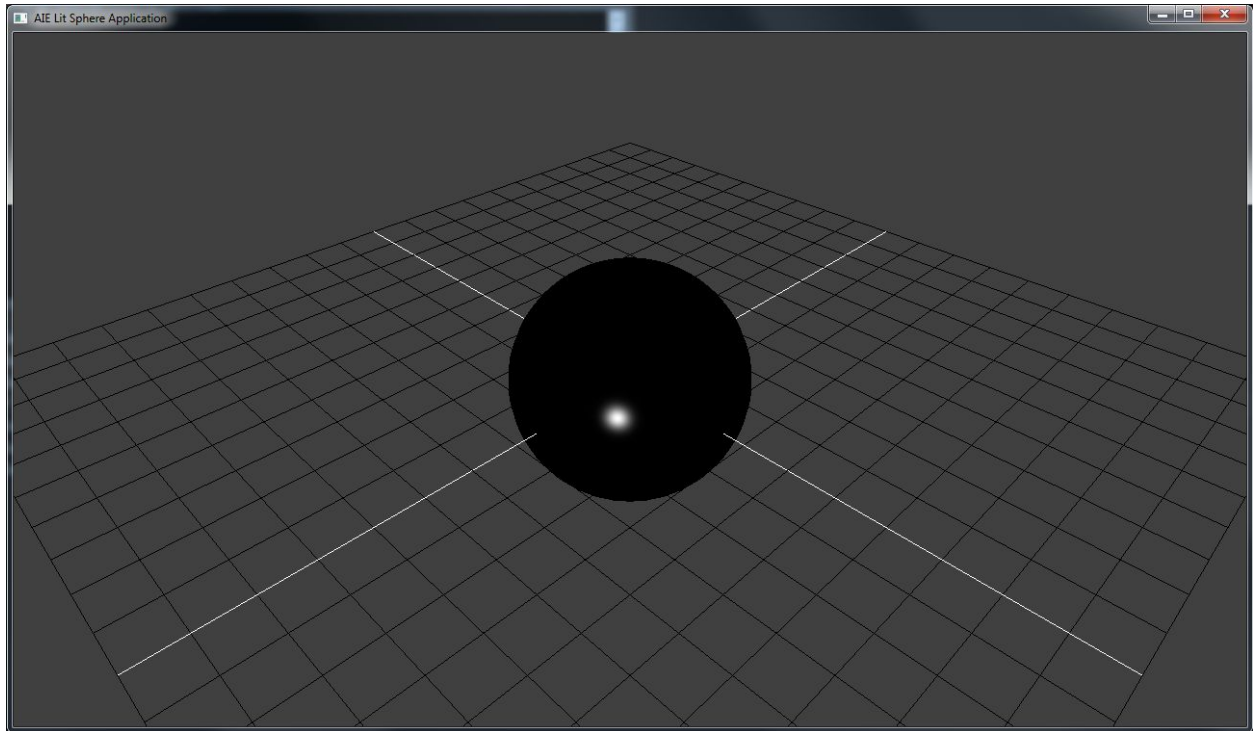
*Picture of ambient lighting using a sphere.

Specular: Color of the reflected light reflected as a single ray off the object's surface. The equation to calculate Specular lighting is as follows: $I_s * K_s * \text{specularTerm}$.

-**K** refers to the surface's material property colors. **s** refers to what light model is being used.

-**I** refers to the light properties. **s** refers to what light model is being used.

-**specularTerm** is the dot product between the light's reflected ray (R_m) and a vector from the surface to the viewer (V). This result is then clamped between zero and one.



*Picture of specular lighting using a sphere.

Both **Phong** and **Blinn-Phong** use simple ambient reflection and the Lambertian for the diffuse reflection, but are different in how the specular reflection is calculated.

Phong: calculates the direction of the reflection vector by using this formula: $\mathbf{R_m} = 2 * \text{dot}(\mathbf{N}, \mathbf{L_m}) * \mathbf{N} - \mathbf{L_m}$, where $\mathbf{L_m}$ is the vector pointing towards the incoming light and \mathbf{N} is the surface normal. Both $\mathbf{L_m}$ and \mathbf{N} must be normalized.

Blinn-Phong: uses the halfway vector. The halfway vector is calculated by using this formula: $\mathbf{H} = \text{normalize}(\mathbf{L_m} + \mathbf{V})$, where $\mathbf{L_m}$ is the vector pointing towards the incoming light and \mathbf{V} is the eye direction.

The Phong model is used for this assessment project.