

CS100433
Computer Graphics

Assignment 3

Questions

1 What are the difference between Local illumination model and Global illumination model?

2 What is the purpose of material attribute?

3 Can you approve Blinn-Phong is an approximation of Phong reflection model?

4 Why Phong shading produce better result than Gouraud shading?

Questions

- 5 What information can be stored in a Texture?
- 6 Why the Texture coordinates require perspective correction?
- 7 What is the cause of aliasing in Textures?
- 8 What are the rendering equation and reflection equation?

Programming

- 1. Render several 3D models with more than two types of lights and various materials (textures)
- 2. Add a Skybox to the rendered scene.

Answer

1 What are the difference between Local illumination model and Global illumination model?

- Local illumination model calculates lighting on a surface directly using the light sources and the surface properties. While global illumination model calculates lighting considering reflectance of light from other surfaces.

2 What is the purpose of material attribute?

- Provides shading parameters such as ambient, diffuse and specular, or BRDF parameters.

Answer

3 Can you approve Blinn-Phong is an approximation of Phong reflection model?

- Draw the figure of $r \cdot v$ and $h \cdot n$. h is the half vector between v and l . When the angle between r and v increases, the angle between h and n also increases and versa vice.
- Approve

Answer

4 Why Phong shading produces better result than Gouraud shading?

- Gouraud shading is vertex-based shading. Colors are interpolated during rasterization. Phong shading is fragment-based shading. Normals are interpolated during rasterization. Therefore Phong shading is more accurate than Gouraud shading.

Answer

- 5 What information can be stored in a Texture?
 - Image, lighting property, general data array or matrix or tensor
- 6 Why the Texture coordinates require perspective correction?
 - The interpolation of texture coordinate in the image space does not match the interpolation of the texture coordinate on the real surface.
- 7 What is the cause of aliasing in Textures?
 - Mismatch between pixels and texels. When the surface is close to the camera, one texel might be projected to multiple pixels, which show the discretization artefacts. However, when the surface is far from the camera, several texels might be projected to one pixel then the pixel value will be determined by one of the texels. In this case, the pixel value might change drastically when the camera pose changed slightly.

Answer

- 8 What are the rendering equation and reflection equation?
 - Refer to the slides of Physically-based rendering. The reflection equation is the reflection part of a rendering equation where the emitting is dropped.

rendering equation:

$$L_o(\mathbf{p}, \omega_o) = L_e(\mathbf{p}, \omega_o) + \int_{\mathcal{H}^2} f_r(\mathbf{p}, \omega_i \rightarrow \omega_o) L_i(\mathbf{p}, \omega_i) \cos\theta d\omega_i$$

reflection equation:

$$L_r(\mathbf{p}, \omega_r) = \int_{\mathcal{H}^2} f_r(\mathbf{p}, \omega_i \rightarrow \omega_r) L_i(\mathbf{p}, \omega_i) \cos\theta_i d\omega_i$$