

CS500 Project 3

Synopsis

Implement reflections, shadows, transmissions and simple anti-aliasing in your growing ray-tracer.

Instructions

Enhance your ray-tracer with the addition of several recursive ray tracing features as well as simple anti-aliasing.

- **Reflections:** Consider a surface to be reflective if it has any amount of specular reflection. If a ray hits such a surface, calculate the usual BRDF lighting for each (visible) light **plus** a similar calculation with $L(R)$, the color returned by tracing the ray in the reflective direction R .

$$\text{output} = \text{ambient} + \left(\sum_{\text{lights}} \text{brdf} (N \cdot L) I \right) + K_s (N \cdot R) L(R) \pi$$

Better yet, instead of the constant K_s , use $F(N \cdot R)$ the Fresnel approx for reflected light $F(u) = K_s + (1 - K_s)(1 - u)^5$

- **Shadows:** When calculating the lighting for a ray's intersection point, determine (for each light) if the light is visible at the point. Do this by firing a ray toward the light, and noting if the ray hits the light or not.
- **Transmission:** Implement a new surface-property

dielectric η r

where η is the index of refraction and r is a reflectivity coefficient.

If a ray hits this surface type, trace out both the reflection vector R to get a color $L(R)$ and a transmission vector T to get a color $L(T)$ and combine them thus:

$$F(N \cdot R) L(R) + (1 - F(N \cdot R)) L(T)$$

where $F(u) = r + (1 - r)(1 - u)^5$ is the Fresnel term.

- **Anti-aliasing:** Implement a simple anti-aliasing scheme – super-sampling on a regular sub-pixel grid with jittering. That is, split a pixel into an $n \times n$ grid of cells, and choose a sample point randomly within each cell. Average the n^2 results for the pixel's color.
- Provide some protection from infinite recursion.

How to submit

Create a zip file containing

- All source files (*.cpp, *.h, and the *.vcxproj file).
- Any scene file you created to test your code, along with a short README describing the scene.

Use the Project-3 link on the Moodle class web page to submit the zip file.