

EXERCISES FOR INF3320

VISUAL APPEARANCE

26/09/2010

1. Describe the difference between flat, Gouraud, and Phong-shading.
2. Given a point \mathbf{p} on a surface with surface normal \mathbf{n} and a light ray coming from a medium with refraction index η_1 and is refracted into a medium with refraction index η_2 . The incoming light ray makes the angle θ with the surface normal.

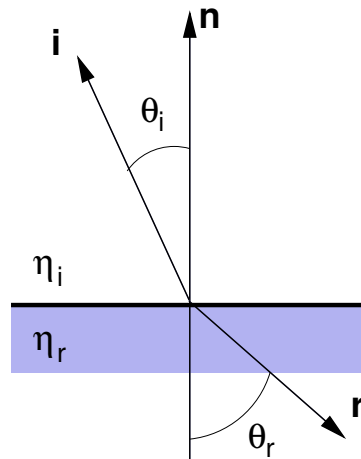
Make a small drawing and set up the relevant expressions for the refracted direction.

When do total reflection happen?

3. Given the unit vector \mathbf{i} that describes the direction of a light ray and a surface normal \mathbf{n} , start with Snell's law and show that the refracted light direction is

$$\mathbf{r} = -\frac{\eta_i}{\eta_r} \mathbf{i} + \left(\frac{\eta_i}{\eta_r} (\mathbf{n} \cdot \mathbf{i}) - \sqrt{1 - \left(\frac{\eta_i}{\eta_r} \right)^2 (1 - (\mathbf{n} \cdot \mathbf{i})^2)} \right) \mathbf{n}.$$

Hint: The vector \mathbf{r} is in the plane spanned by \mathbf{i} and \mathbf{n} and is a unit vector.



4. In `ex_5-4_refraction.cpp.template`, implement `reflect` that returns the reflected direction, `totalReflection` that checks if a total reflection occurs, and `refract` that returns the refracted vector.
5. In `ex_5-5_lighting.cpp.template`, implement `reflect` and `phong` which reflects a vector and evaluates the phong lighting model respectively.