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.

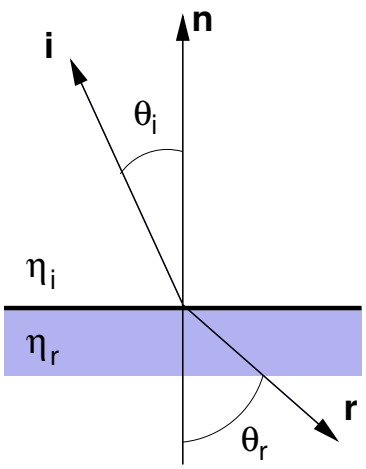
   Make a small drawing and set up the relevant expressions for the refracted direction.

   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 occours, 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.