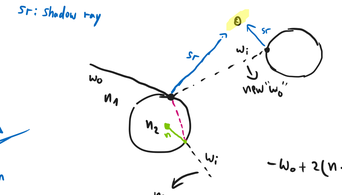
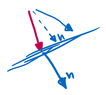
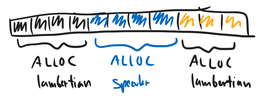






$-w_o + 2(n \cdot w_o)n$

$$L = I_a + \sum_{i=1}^{i:ls} Kd(N \cdot L_i) + K_s S + K_t T$$

$$L = I_a + \sum_{i=1}^{i:ls} Kd(N \cdot L_i) + K_s\left(I_a + \sum_{i=1}^{i:ls} Kd(N \cdot L_i) + K_s S + K_T T\right) + K_T T$$

For loop for every light

Fresnel BRDF "Specular Reflection"

$Kd(N \cdot L_1) + Kd(N \cdot L_2) + \ldots + Kd(N \cdot L_n)$

$F \cdot I \cdot \cos\theta_1$

1.0

$\cos\theta_t = \sqrt{1 - \sin^2\theta_t}$

$\eta_1 \sin\theta_i = \eta_2 \sin\theta_t$

$\frac{\eta_1}{\eta_2}\sin\theta_i = \sin\theta_t \rightarrow \left(\frac{\eta_1}{\eta_2}\right)^2 \sin^2\theta_i = \sin^2\theta_t$

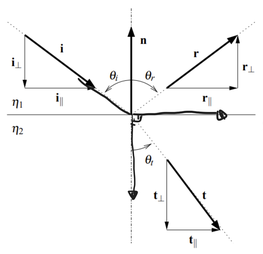
$\left(\frac{\eta_1}{\eta_2}\right)^2 (1 - \cos^2\theta_i)^2 = \sin^2\theta_t$ (1)

$\sin^2\theta + \cos^2\theta = 1$

$\sin^2\theta_i = 1 - \cos^2\theta_i$

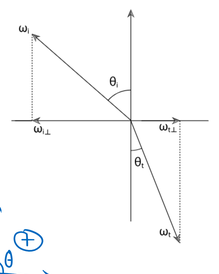
$\sin\theta_i = \sqrt{1 - \cos^2\theta_i}$

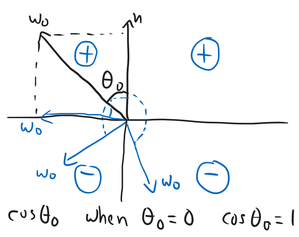
$\sin\theta_t = \frac{\eta_1}{\eta_2}\sqrt{1 - \cos^2\theta_i}$



θ_t when $\theta_t = 90°$ or $\frac{\pi}{2}$ is 1.

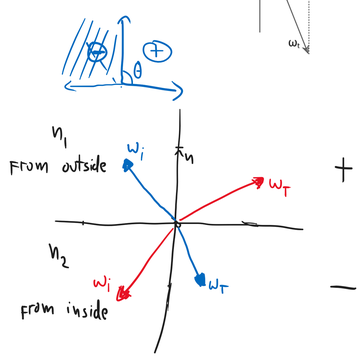
Sin when $\sin\theta_t \geq 1$ is total internal reflection





$\cos\theta_o$ when $\theta_o = 0$ $\cos\theta_o = 1$

$\theta_o = \frac{\pi}{2}$ $\cos\theta_o = 0$



with Fresnel, we don't care about the direction of reflection or refraction, we just compute how much of the radiance will be reflected and refracted given an incident angle θ_i. That's why $\cos\theta_i$, even if w_i is coming from inside of the object, is always non-negative, because we only are interested in determining the n_1 and n_2 indices of refraction. If w_i is coming from inside of the object then the "incident" index of refraction is n_2. Otherwise is the regular case: n_1.

$w_{t\parallel} = w_t - w_{t\perp}$

$\|w_{t\parallel}\|^2 = \|w_t\|^2 - \|w_{t\perp}\|^2$ where $\|w_t\| = 1$ (Pythagoras)

$\|w_{t\parallel}\| = \sqrt{1 - \|w_{t\perp}\|^2}$

$w_{t\parallel} = -\left(\sqrt{1 - \|w_{t\perp}\|^2}\right) n$

$$w_t = \frac{n_i}{n_t}(-w_i + (w_i \cdot n)n) - \left(\sqrt{1 - \|w_{t\perp}\|^2}\right) n$$

$$= \frac{n_i}{n_t}(-w_i) + \left[\frac{n_i}{n_t}(w_i \cdot n) - \sqrt{1 - \|w_{t\perp}\|^2}\right] n$$

$1 - \sin^2\theta_t = \cos^2\theta_t$

$\|w_{t\perp}\| = \sin\theta_t \rightarrow \|w_{t\perp}\|^2 = \sin^2\theta_t$

$$= \frac{n_i}{n_t}(-w_i) + \left[\frac{n_i}{n_t}(w_i \cdot n) - \cos\theta_t\right] n$$

$$\cos\theta_t = \sqrt{1 - \frac{n_i^2}{n_t^2}\sin^2\theta_i}$$

$\cos^2\theta_i + \sin^2\theta_i = 1$

$\sin^2\theta_i = 1 - \cos^2\theta_i$