Equation Summary

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Here are some useful equations for the Trace assignment:

Direct Illumination

$$I_{\text{direct}} = k_e + \sum_j k_d I_{La,j} + A_j^{\text{shadow}} A_j^{\text{dist}} I_{L,j} B_j \left(k_d (\mathbf{N} \cdot \mathbf{L}_j) + k_s (\mathbf{N} \cdot \mathbf{H}_j)_+^{n_s} \right)$$

$$A_j^{\text{dist}} = \min \left(1, \frac{1}{a_j + b_j r_j + c_j r_j^2} \right)$$

Direct plus Indirect Illumination

$$I_{\text{total}} = I_{\text{direct}} + k_r I_{\text{reflectedRay}} + k_t I_{\text{transmittedRay}}$$

Reflection Direction

$$\mathbf{R} = 2(\mathbf{V} \cdot \mathbf{N})\mathbf{N} - \mathbf{V}$$

Refraction Direction

$$\eta = \frac{\eta_i}{\eta_t}$$

$$\cos \theta_i = \mathbf{N} \cdot \mathbf{V}$$

$$\cos \theta_t = \sqrt{1 - \eta^2 (1 - \cos^2 \theta_i)}$$

$$\mathbf{T} = (\eta \cos \theta_i - \cos \theta_t)\mathbf{N} - \eta \mathbf{V}$$

Note that Total Internal Reflection (TIR) occurs when the square root term above is negative.