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Assignment Nr. 4

4.1 Radiometry

Let w' be the direction from x to d

$$\begin{aligned}
E &= \int_\omega L(x,w)cos(\theta)d\omega \\
&= L(x,w')cos(\theta) \\
&= \frac{d^2\Phi cos(\theta)}{dAcos(\theta)d\omega} \\
\text{as a point is perpendicular to another cos =1} \\
&= \frac{d^2\Phi cos(\theta)}{dA1d\omega} \\
\text{Assume } dA = 1\text{, then } dw = 4\pi r^2 \\
&= \frac{d^2\Phi cos(\theta)}{4\pi r^2} \\
\text{The radius is given by } r = \sqrt{r^2+d^2} \\
&= \frac{d^2\Phi cos(\theta)}{4\pi r^2 + d^2}
\end{aligned}$$

4.2 Analytical solution of the rendering equation in 2D

a)

$$L(x,\omega_o) = L_e(x,\omega_o) + \int_0^{\pi} f_r(\omega_i,x,\omega_o)L(x,\omega_i)cos(\theta_i)d\omega_i$$
$$= 0 + \int_0^{\pi} \frac{1}{2}L(x,\omega_i)cos(\theta_i)d\omega_i$$
$$= \frac{1}{2}\int_0^{\pi} L(x,\omega_i)cos(\theta_i)d\omega_i$$
$$= \frac{1}{2}\int_0^{\pi} L(x,\omega_i)cos(\theta_i)d\omega_i$$
$$= \frac{1}{2}(\int_0^{tan^{-1}(\frac{1}{p+1})} L(x,\omega_i)cos(\theta_i)d\omega_i + \int_{tan^{-1}(\frac{1}{p+1})}^{\pi-tan^{-1}(\frac{1}{1-p})} L(x,\omega_i)cos(\theta_i)d\omega_i + \int_{\pi-tan^{-1}(\frac{1}{1-p})}^{\pi} L(x,\omega_i)cos($$

The first and the third integral refer to incident angles that point past the light source, therefore t

$$= \frac{1}{2}\int_{tan^{-1}(\frac{1}{p+1})}^{\pi-tan^{-1}(\frac{1}{1-p})} 1\cdot cos(\theta_i)d\omega_i$$
$$= \frac{1}{2}\int_{tan^{-1}(\frac{1}{p+1})}^{\pi-tan^{-1}(\frac{1}{1-p})} cos(|\omega_i - \frac{\pi}{2}|)d\omega_i$$
$$= \frac{1}{2}\left(\int_{tan^{-1}(\frac{1}{p+1})}^{\frac{\pi}{2}} cos(\frac{\pi}{2}-\omega_i)d\omega_i + \int_{\frac{\pi}{2}}^{\pi-tan^{-1}(\frac{1}{1-p})} cos(\omega_i-\frac{\pi}{2})d\omega_i\right)$$

4.3 Simple Path Tracer