

Computer Graphics Lecture Notes

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Acknowledgement

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1 Optics

Definition 1.1. Radiant Intensity of a light source: $I(\omega) = d\Phi/d\omega$

- Total light power (exiting a light) per unit solid angle
- Measure of how strong a (point) light source is

Definition 1.2. Irradiance on a surface: $E = d\Phi/dA$

- Total light power (hitting a surface) per unit surface area.
- Measure of how much light is hitting a surface.
- Varies based on distance from the light and the tilting angle of the surface.

Some engineering approximations are as follows.

- BRDF (Bidirectional Reflectance Distribution Function): models how much light is reflected.
- BTDF (Bidirectional Transmittance Distribution Function): models how much light is transmitted.
- BSSRDF (Bidirectional Surface Scattering Reflectance Distribution Function): combined reflection/transmission model.

Now we define the **lighting equation**:

$$L_o(\omega_0) = \sum_{i \in \text{in}} L_{o \text{ due to } i}(\omega_i, \omega_o)$$

where the BRDF gives each of $L_{o \text{ due to } i}(\omega_i, \omega_o)$. Then we have

$$L_o(\omega_0) = \int_{i \in \text{in}} \text{BRDF}(\omega_i, \omega_0) dE_i(\omega_i) = \int_{i \in \text{in}} \text{BRDF}(\omega_i, \omega_0) L_i \cos \theta_i d\omega_i.$$

Diffuse Materials: a surface reflects light equally in all directions. I.e., $\text{BRDF} = \text{Const.}$