1.5: Reflectance Functions

In the most general case of diffuse reflection, the reflectance of a surface will depend on both the direction of the incident radiation and that of the reflected radiation. The *bidirectional reflectance distribution function*, f_r, links the *irradiance* E to the reflected radiance, such that

$$L_r = f_r\left(\mu, \varphi; \mu_0, \varphi_0\right) E\left(\mu_0, \varphi_0\right). \tag{1.5.1}$$

For a surface irradiated with flux density $\mathbf{F}$, the irradiance is simply the component of the flux density perpendicular to the surface

$$E = \mu_0 \mathbf{F}, \tag{1.5.2}$$

so that, abbreviated, we can write

$$L_r = f_r \mu_0 \mathbf{F} \tag{1.5.3}$$

One of the simplest examples of a reflectance rule is that of a Lambertian reflecting surface for which the radiance is isotropic, so that

$$L_r = \frac{\lambda_0}{\pi} \mu_0 \mathbf{F}, \tag{1.5.4}$$

where λ_0 is sometimes referred to as the Lambertian albedo . Although it is not strictly physically correct, it is convenient (Chandrasekhar, p147) to identify λ_0 with the single scattering albedo ϖ_0, so for Lambert's law the BRDF is

$$f_r = \frac{\varpi_0}{\pi}. \tag{1.5.5}$$

For the most part, we shall refer all reflectance rules used to a BRDF; alternative reflectance functions will be discussed in Section 1.7.