Miss Shaders & Sky Models Activity Worksheet

YouTube Video(s)

- Miss Shaders and Sky Models
- Hosek-Wilkie Cube Map
- Hosek-Wilkie Cylinder Map

Outline

- Ray Tracing Pipeline
- Miss Shaders
- Sky Models
- Frame of Reference

Activities

1. Try your hand at verifying the sun's position. From the Preetham et al. paper, appendix A.6 has the sun's position given by the equations

$$t = t_s + 0.170 \sin\left(\frac{4\pi(J-80)}{373}\right) - 0.129 \sin\left(\frac{2\pi(J-8)}{355}\right) + \frac{12(SM-L)}{\pi}$$

$$\delta = 0.4093 \sin\left(\frac{2\pi(J-81)}{368}\right)$$

$$\theta_s = \frac{\pi}{2} - \arcsin\left(\sin l \sin\delta - \cos l \cos\delta \cos\frac{\pi t}{12}\right)$$

$$\phi_s = \arctan\left(\frac{-\cos\delta \sin\frac{\pi t}{12}}{\cos l \sin\delta - \sin l \cos\delta \cos\frac{\pi t}{12}}\right)$$

term	math term	units
Solar zenith	θ_s	radians
Solar azimulth	ϕ_s	radians
Solar time	t	decimal hours
Standard time	t_s	decimal hours
Solar declination	δ	radians
Standard meridian	SM	radians
Site latitude	l	radians
Site longitude	L	radians
Julian date	J	1 to 365
Zenith luminance	Y_z	

term	math term	units
Sky Luminance	Y_C	
Overcast sky	$Y_O C$	

2. Calculate the sun's position for Fairbanks ($l = 64.837, L = -147.716$) for January 1st, 2018 ($J = 1$) at noon ($t_s = 12.0$).
3. Calculate the sun's position for Fairbanks for July 1st, 2018 ($J = 182$).
4. The clear sky and overcast sky luminance as adopted as the CIE standard is given by

$$Y_C = Y_z \frac{(0.91 + 10e^{-3\gamma} + 0.45\cos^2\gamma)(1 - e^{-0.32/\cos\theta})}{(0.91 + 10e^{-3\theta_s} + 0.45\cos^2\theta_s)(1 - e^{-0.32})}$$

$$Y_{OC} = Y_z \frac{(1 + 2\cos\theta)}{3}$$

5. Assume that Y_z is the luminance at zenith (assume 1). What would be the luminance of the sky at vector $(1, 1, 1)^T$?

Graduate Student Activities

1. A Practical Analytic Model for Daylight by Preetham, Shirley, and Smits
2. An Analytic Model for Full Spectral Sky-Dome Radiance by Hosek and Wilkie