Quiz #4
ECE 816 Spring Quarter 2007
May 14th, 2007

Consider the discretized angle solution of the radiative transfer equation (using $N = 1$) in this problem. A plane wave having $F_0 = 1$ (Watts/square meter/Hz) is normally incident (i.e. propagating in the plus z direction) on a planar medium of optical thickness $\tau_0 = 2$. The medium contains isotropic scatterers of albedo $W_0 = 0.2$, and all media have the same background dielectric constant so that interface reflections are not present.

(a) Find μ_1 and μ_{-1} and the corresponding angles of propagation with respect to the z axis.

From the book/notes, $\mu_1 = -\mu_{-1} = \frac{1}{\sqrt{3}}$ so that $\theta_1 = \pi - \theta_{-1} = \text{acos}\frac{1}{\sqrt{3}} = 54.74°$

(b) Find α_1.

From the book, $\alpha_1 = \frac{\left(1 + \frac{1}{\sqrt{3}}\right)}{1 - 0.2 - \frac{1}{3}}\left(\frac{0.2}{4\pi}\right) = 0.0538$

(c) If W_0 is now allowed to vary, find a value of W_0 that makes α_1 singular.

Singularity will happen when the denominator is zero, or when $1 - W_0 - \frac{1}{3} = 0$

This occurs when $W_0 = \frac{2}{3}$.