ΠΕΔΙΑ Α 21/09/2010

$\Theta\epsilon\mu\alpha$ 1

(α)

$$\vec{E} = \begin{cases} -\frac{1}{2\epsilon_0}\left[\sigma_1 + \frac{2\rho_0}{g}(1-e^{-gd}) + \sigma_2\right]\ \hat{i}_x + \vec{E}_{wire}, & \text{for } x < -(\mathrm{a}+d), \\ -\frac{1}{2\epsilon_0}\left[-\sigma_1 + \frac{2\rho_0}{g}(1-e^{-gd}) + \sigma_2\right]\ \hat{i}_x + \vec{E}_{wire}, & \text{for } -(\mathrm{a}+d) < x < -d, \\ \frac{1}{2\epsilon_0}\left[\sigma_1 + \frac{2\rho_0}{g}(e^{gx}-1) - \sigma_2\right]\ \hat{i}_x + \vec{E}_{wire}, & \text{for } -d < x < 0, \\ \frac{1}{2\epsilon_0}\left[-\sigma_1 + \frac{2\rho_0}{g}(1-e^{-gx}) - \sigma_2\right]\ \hat{i}_x + \vec{E}_{wire}, & \text{for } 0 < x < d, \\ \frac{1}{2\epsilon_0}\left[\sigma_1 + \frac{2\rho_0}{g}(1-e^{-gd}) - \sigma_2\right]\ \hat{i}_x + \vec{E}_{wire}, & \text{for } d < x < (d+c), \\ \frac{1}{2\epsilon_0}\left[\sigma_1 + \frac{2\rho_0}{g}(1-e^{-gd}) + \sigma_2\right]\ \hat{i}_x + \vec{E}_{wire}, & \text{for } x > (d+c), \\ \vec{E}_{wire} = \frac{\lambda_0}{2\pi\epsilon_0}\left[\frac{x-(b+d)}{(x-(b+d))^2+y^2}\ \hat{i}_x + \frac{y}{(x-(b+d))^2+y^2}\ \hat{i}_y\right]. \end{cases}$$

(β)

Cylinder

$$\left[x - (d+b+\frac{1}{2k})\right]^2 + y^2 = \left(\frac{1}{2k}\right)^2$$
$$k = \frac{\pi}{\lambda_0}\left[\sigma_2 - \sigma_1 + \frac{2\rho_0}{g}(1-e^{-gd})\right]$$

(γ)

$$\vec{f} = \frac{\rho_0}{g}(1-e^{-gd})(\sigma_1-\sigma_2)\ \hat{i}_x$$
$$\frac{W_e}{S} = \frac{\epsilon_0}{2}\int_{-d}^{+d} E^2(x)dx$$

(δ)

$$\vec{f} = \frac{\lambda_0}{2\epsilon_0}\left[\sigma_1 - \sigma_2 + \frac{2\rho_0}{g}(1-e^{-gd})\right]\ \hat{i}_x$$

$\Theta\epsilon\mu\alpha$ 2

(α)

$$\vec{K}_1(r_T) = \frac{(1-k)I_0}{2\pi r_T}\hat{i}_{r_T}, \qquad \text{for} \;\; 0 < r_T < \mathrm{b},$$

$$\vec{K}_2(z) = \frac{(1-k)I_0}{2\pi[\mathrm{a} - \frac{\mathrm{a}-\mathrm{b}}{h}z]}(-\cos\theta_0\hat{i}_z + \sin\theta_0\hat{i}_{r_T}), \qquad \text{for} \;\; 0 < z < h,$$

$$\theta_0 = \tan^{-1}\left(\frac{\mathrm{a}-\mathrm{b}}{h}\right),$$

$$\vec{K}_3(r_T) = \frac{(1-k)I_0}{2\pi r_T}\hat{i}_{r_T}, \qquad \text{for} \;\; r_T > \mathrm{a},$$

$$\vec{J}(r_T, z) = \gamma\frac{kI_0}{2\pi r_T}\exp(\gamma z)\hat{i}_{r_T}, \qquad \text{for} \;\; z < 0.$$

(β)

$$\vec{H}(r_T, z) = \hat{i}_\phi \begin{cases} -\dfrac{I_0}{2\pi r_T}, & \text{for } z > h \text{ and } r_T > 0, \\ -\dfrac{kI_0}{2\pi r_T} & \text{for } 0 < z < h \;\; \text{and} \;\; r_T < r_T(z) = \mathrm{a} - \frac{\mathrm{a}-\mathrm{b}}{h}z, \\ -\dfrac{I_0}{2\pi r_T} & \text{for } 0 < z < h \;\; \text{and} \;\; r_T > r_T(z) \\ -\dfrac{kI_0}{2\pi r_T}e^{\gamma z} & \text{for } z < 0 \;\; \text{and} \;\; r_T > 0 \end{cases}$$

(γ)

$$\vec{f}(r_T, z = h) = -\hat{i}_z\mu_0\frac{I_0^2(1-k^2)}{8\pi^2 r_T^2}, \qquad \text{for} \;\; 0 < r_T < \mathrm{b},$$

$$\vec{f}(z) = \mu_0\frac{I_0^2(1-k^2)}{8\pi^2 r_T^2(z)}(\cos\theta_0\hat{i}_{r_T} - \sin\theta_0\hat{i}_z), \qquad \text{for} \;\; 0 < z < h,$$

$$\text{with } r_T(z) = \mathrm{a} - \frac{\mathrm{a}-\mathrm{b}}{h}z.$$

<u>$\Theta\epsilon\mu\alpha$ 3</u>

(α)

$$\lambda_0 = 6.28\,cm,$$

$$\begin{aligned} f &= 4.7746\, GHz \\ \theta_1 &= 30\, deg \\ \text{Incident Wave Polarization} &= \text{Linear Polarization and specifically TM} \end{aligned}$$

(β)

$$\vec{E}_r = 16956.7[-\frac{\sqrt{3}}{2}\ \hat{i}_x - \frac{1}{2}\ \hat{i}_z] \exp[-j(50x - 50\sqrt{3}z)]\ (Volts/meter),$$

Reflected Wave Polarization = Linear Polarization and specifically TM.

(γ)

$$\vec{E}_t = 18218.9[\cos\theta_2\ \hat{i}_x - \sin\theta_2\ \hat{i}_z] \exp[-j(50x + 295.8z)]\ (Volts/meter), \qquad \theta_2 = 9.59\, deg,$$

Transmitted Wave Polarization = Linear Polarization and specifically TM.

(δ)

$$\vec{\mathcal{H}}_t = 144.98\ \hat{i}_y \cos\left[2\pi 4.7746 \times 10^9 t - (50x + 295.8z)\right] (Ampere/meter).$$

(ϵ)

$$\vec{\mathcal{P}}_{avg_2} = 1.3207 \times 10^6 [0.1666\ \hat{i}_x + 0.986\ \hat{i}_z]\ (Watt/meter^2)$$

($\sigma\tau$)

$$\begin{aligned} P_r/P_{inc} &= 0.2023 = 20.23\%, \\ P_t/P_{inc} &= 0.7977 = 79.77\%. \end{aligned}$$