ΠΕΔΙΑ Β 04/11/2011

$\Theta\epsilon\mu\alpha$ 1

(α)

$$\Phi(x,y,z) = \frac{\lambda}{4\pi\epsilon_1}\ln\Big[\frac{z+\sqrt{x^2+y^2+z^2}}{z-L_1+\sqrt{x^2+y^2+(z-L_1)^2}}\Big] +$$

$$\frac{\lambda}{4\pi\epsilon_1}\frac{\epsilon_1-\epsilon_2}{\epsilon_1+\epsilon_2}\ln\Big[\frac{z+L_1+\sqrt{x^2+y^2+(z+L_1)^2}}{z+\sqrt{x^2+y^2+z^2}}\Big] +$$

$$\frac{\lambda}{4\pi\epsilon_1}\frac{2\epsilon_1}{\epsilon_1+\epsilon_2}\ln\Big[\frac{z+L_2+\sqrt{x^2+y^2+(z+L_2)^2}}{z+\sqrt{x^2+y^2+z^2}}\Big], \qquad \text{for } z>0,$$

$$\Phi(x,y,z) = \frac{\lambda}{4\pi\epsilon_2}\frac{2\epsilon_2}{\epsilon_1+\epsilon_2}\ln\Big[\frac{z+\sqrt{x^2+y^2+z^2}}{z-L_1+\sqrt{x^2+y^2+(z-L_1)^2}}\Big] +$$

$$\frac{\lambda}{4\pi\epsilon_1}\frac{\epsilon_2-\epsilon_1}{\epsilon_1+\epsilon_2}\ln\Big[\frac{z+\sqrt{x^2+y^2+z^2}}{z-L_2+\sqrt{x^2+y^2+(z-L_2)^2}}\Big] +$$

$$\frac{\lambda}{4\pi\epsilon_1}\ln\Big[\frac{z+L_2+\sqrt{x^2+y^2+(z+L_2)^2}}{z+\sqrt{x^2+y^2+z^2}}\Big], \qquad \text{for } z<0.$$

(β)

$$E_x(x,z=0^+) = E_x(x,z=0^-) = \frac{\lambda}{4\pi(\epsilon_1+\epsilon_2)}\frac{1}{x}\Big[\frac{L_1}{\sqrt{x^2+L_1^2}} + \frac{L_2}{(\sqrt{x^2+L_2^2}}\Big],$$

$$E_z(x,z=0^+) = \frac{\epsilon_2}{\epsilon_1}E_z(x,z=0^-) = \frac{\lambda}{4\pi\epsilon_1}\Big[\frac{2(\epsilon_2-\epsilon_1)}{\epsilon_2+\epsilon_1)}\frac{1}{|x|} + \frac{-2\epsilon_2}{\epsilon_2+\epsilon_1}\frac{1}{\sqrt{x^2+L_1^2}} + \frac{2\epsilon_1}{\epsilon_2+\epsilon_1}\frac{1}{\sqrt{x^2+L_2^2}}\Big].$$

$\Theta\epsilon\mu\alpha$ 2

(α)

$$p_{11} = p_{22} = \frac{1}{2\pi\epsilon_0}\ln\Big(\frac{2h}{\mathrm{a}}\Big),$$

$$p_{12} = p_{21} = \frac{1}{2\pi\epsilon_0}\ln\Big(\frac{\sqrt{d^2+4h^2}}{d}\Big).$$

(β)

$$C_{11} = C_{22} = \frac{2\pi\epsilon_0}{\ln\left(\frac{2h}{\mathrm{a}}\frac{\sqrt{d^2+4h^2}}{d}\right)},$$

$$C_{12} = C_{21} = \frac{2\pi\epsilon_0 \ln\left(\frac{\sqrt{d^2+4h^2}}{d}\right)}{\ln\left(\frac{2h}{\mathrm{a}}\frac{\sqrt{d^2+4h^2}}{d}\right)\ln\left(\frac{2h}{\mathrm{a}}\frac{d}{\sqrt{d^2+4h^2}}\right)}.$$

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

(α)

$$\vec{A}(x,y,z) = \frac{\mu_0 I_1}{4\pi}\int_0^{2\pi}\frac{\mathrm{a}(\cos\phi_1\hat{i}_x - \sin\phi_1\hat{i}_z)}{\sqrt{(x-\mathrm{a}\sin\phi_1)^2+y^2+(z-\mathrm{a}\cos\phi_1)^2}}d\phi_1 +$$

$$\frac{\mu_0 I_2}{4\pi}\int_0^{2\pi}\frac{\mathrm{a}(-\sin\phi_2\hat{i}_x - \cos\phi_2\hat{i}_z)}{\sqrt{(x-x_0-\mathrm{a}\cos\phi_2)^2+(y-y_0-\mathrm{a}\sin\phi_2)^2+z^2}}d\phi_2$$

(β)

$$\vec{A}(x,y,z) = \frac{\mu_0\pi\mathrm{a}^2 I_1}{4\pi}\frac{z\hat{i}_x - x\hat{i}_z}{(x^2+y^2+z^2)^{3/2}} + \frac{\mu_0\pi\mathrm{a}^2 I_2}{4\pi}\frac{-(y-y_0)\hat{i}_x+(x-x_0)\hat{i}_y}{[(x-x_0)^2+(y-y_0)^2+z^2]^{3/2}}$$

(γ)

$$\vec{H} = \frac{I_1\mathrm{a}^2}{2}\frac{1}{y^3}\hat{i}_y + \frac{I_2\mathrm{a}^2}{4}\frac{1}{[x_0^2+(y-y_0)^2]^{3/2}}\hat{i}_z$$

<u>$\Theta\epsilon\mu\alpha$ 4</u>

(α)

$$\Phi(r_T,\phi) = \left[-E_0 r_T + \frac{B_1}{r_T}\right]\cos\phi \qquad r_T \geq b,$$

$$\Phi(r_T,\phi) = \left[A_2 r_T + \frac{B_2}{r_T}\right]\cos\phi \qquad a \leq r_T \leq b,$$

$$\Phi(r_T,\phi) = A_3 r_T\cos\phi \qquad r_T \leq a,$$

$$B_1 = K\,\frac{E_0 b^2[1-(a/b)^2]}{1-K^2(a/b)^2},$$

$$A_3 = E_0\,\frac{K^2-1}{1-K^2(a/b)^2},$$

$$A_2 = \frac{E_0}{2}\,\frac{K^2-1}{1-K^2(a/b)^2}\,\left(1+\frac{\epsilon_1}{\epsilon_2}\right),$$

$$
\begin{aligned}
B_2 &= \frac{E_0}{2}a^2 \, \frac{K^2-1}{1-K^2(a/b)^2} \, \Big(1-\frac{\epsilon_1}{\epsilon_2}\Big), \\
K &= \frac{\epsilon_2-\epsilon_1}{\epsilon_2+\epsilon_1}.
\end{aligned}
$$

(β)

$$
\frac{|E_3|}{E_0} = \frac{16(\epsilon_2/\epsilon_1)}{[3(\epsilon_2/\epsilon_1)+1][(\epsilon_2/\epsilon_1)+3]}
$$

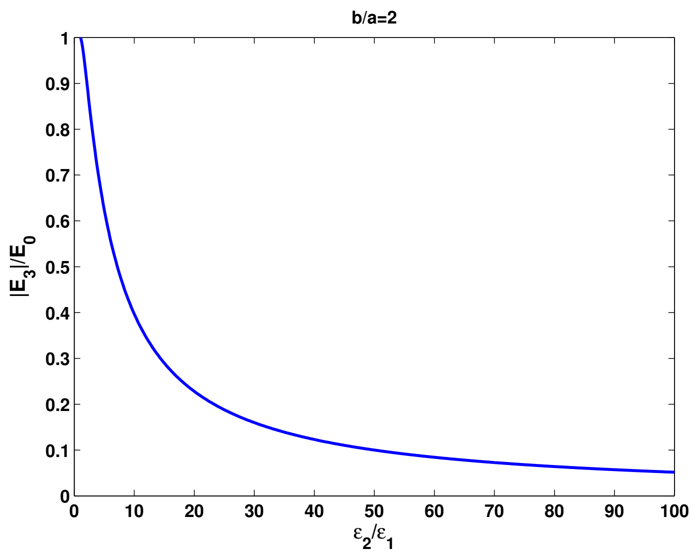

Figure 1: $|E_3|/E_0$ dependence on ϵ_2/ϵ_1 ratio. The high dielectric hollow cylinder protects its interior from the externally applied field E_0.