ΠΕΔΙΑ   Β   31/10/2007

$\Theta\epsilon\mu\alpha$ 1

(α)

$$\Phi(r,\theta,\phi) = \frac{p_0 r\cos\theta}{4\pi\epsilon_0[r^2+d^2-2rd\sin\theta\cos\phi]^{3/2}} + \frac{-p_0(\mathrm{a}/d)r\cos\theta}{4\pi\epsilon_0[r^2+d'^2-2rd'\sin\theta\cos\phi]^{3/2}}$$

$$d' = \frac{\mathrm{a}^2}{d}$$

(α)   (more accurate)

$$\Phi(r,\theta,\phi) = \frac{p_0 r\cos\theta}{4\pi\epsilon_0[r^2+d^2-2rd\sin\theta\cos\phi]^{3/2}} + \frac{-p_0(\mathrm{a}/d)^3 r\cos\theta}{4\pi\epsilon_0[r^2+d'^2-2rd'\sin\theta\cos\phi]^{3/2}}$$

$$d' = \frac{\mathrm{a}^2}{d}$$

(β)

$$\sigma(\theta,\phi) = \frac{3p_0\mathrm{a}\cos\theta(\mathrm{a}-d\sin\theta\cos\phi) - p_0\mathrm{a}\cos\theta R^2}{4\pi\epsilon_0 R^5} + \frac{-3p_0 d'\cos\theta(a-d'\sin\theta\cos\phi) + d'p_0\cos\theta R'^2}{4\pi\epsilon_0 R'^5}$$

$$d' = \frac{\mathrm{a}^2}{d},$$
$$R = [\mathrm{a}^2+d^2-2d\mathrm{a}\sin\theta\cos\phi]^{1/2},$$
$$R' = [\mathrm{a}^2+d'^2-2d'\mathrm{a}\sin\theta\cos\phi]^{1/2}.$$

(β)   (more accurate)

$$\sigma(\theta,\phi) = \frac{3p_0\mathrm{a}\cos\theta(\mathrm{a}-d\sin\theta\cos\phi) - p_0\mathrm{a}\cos\theta R^2}{4\pi\epsilon_0 R^5} + \frac{a^2}{d^2}\frac{-3p_0 d'\cos\theta(a-d'\sin\theta\cos\phi) + d'p_0\cos\theta R'^2}{4\pi\epsilon_0 R'^5}$$

$$d' = \frac{\mathrm{a}^2}{d},$$
$$R = [\mathrm{a}^2+d^2-2d\mathrm{a}\sin\theta\cos\phi]^{1/2},$$
$$R' = [\mathrm{a}^2+d'^2-2d'\mathrm{a}\sin\theta\cos\phi]^{1/2}.$$

Θεμα 2

(α)

$$\vec{H} = \hat{i}_z \frac{M_0}{2}\Big[\ \frac{(d/2) - z}{[\mathrm{a}^2 + (z - (d/2))^2]^{1/2}} + \frac{(d/2) + z}{[\mathrm{a}^2 + (z + (d/2))^2]^{1/2}}\Big] \qquad |z| > d/2$$

$$\vec{H} = \hat{i}_z \frac{M_0}{2}\Big[\ \frac{(d/2) - z}{[\mathrm{a}^2 + (z - (d/2))^2]^{1/2}} + \frac{(d/2) + z}{[\mathrm{a}^2 + (z + (d/2))^2]^{1/2}}\Big] - M_0 \hat{i}_z \qquad |z| < d/2$$

(β)

$$\Psi_m = \frac{\mu_0}{2}\ \frac{\pi \mathrm{a}^2 d M_0}{b}$$

Θεμα 3

$$L_{12} = L_{21} = -\frac{\mu_0 \mathrm{a}^2}{8\pi}\Big[\frac{1}{(d - \mathrm{a}/2)^2} - \frac{1}{(d + \mathrm{a}/2)^2}\Big]$$

$\underline{\Theta\epsilon\mu\alpha \quad 4}$

(α)

$$\Phi_1(x) = \frac{V}{\mathrm{a}}x, \qquad \vec{E}_1 = -\hat{i}_x\frac{V}{\mathrm{a}}, \qquad \vec{J}_1 = -\hat{i}_x\sigma\frac{V}{\mathrm{a}},$$

$$\Phi_2(y) = \frac{V}{\mathrm{a}}y, \qquad \vec{E}_2 = -\hat{i}_y\frac{V}{\mathrm{a}}, \qquad \vec{J}_2 = -\hat{i}_y\sigma\frac{V}{\mathrm{a}},$$

(β)

$$\Phi(x,y) = \frac{V}{\mathrm{a}^2}xy, \qquad \text{for} \quad 0 \le x \le \mathrm{a}, \;\; 0 \le y \le \mathrm{a},$$

$$\vec{E} = -\frac{V}{\mathrm{a}^2}\left(y\hat{i}_x + x\hat{i}_y\right), \qquad \text{for} \quad 0 \le x \le \mathrm{a}, \;\; 0 \le y \le \mathrm{a}.$$

(γ)

$$\sigma(x=\mathrm{a},y) = \frac{V}{\mathrm{a}^2}\epsilon_0 y,$$

$$\sigma(x,y=\mathrm{a}) = \frac{V}{\mathrm{a}^2}\epsilon_0 x.$$