$\Theta\epsilon\mu\alpha$ 1

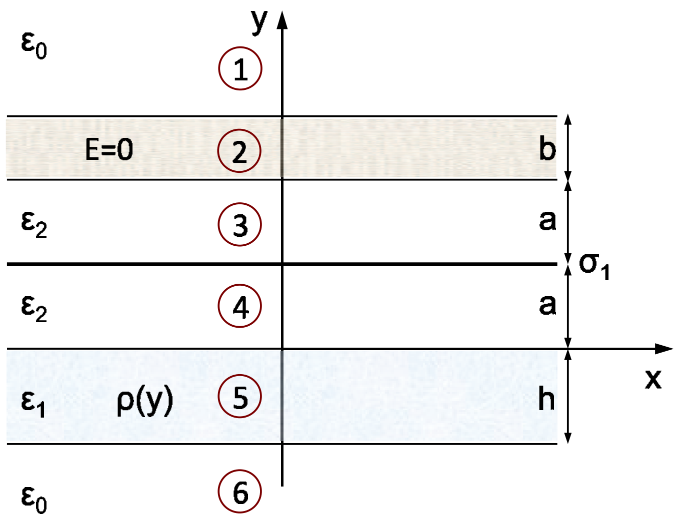

Figure 1: (Problem 1) Given structure geometry with specified (numbered) regions of interest.

(α)

$$\sigma(y=2a) = -\left[\frac{\sigma_1}{2} - \frac{\rho_0 h}{\pi}\right],$$
$$\sigma(y=2a+b) = +\left[\frac{\sigma_1}{2} - \frac{\rho_0 h}{\pi}\right],$$

(β)

$$\vec{E}_1 = \hat{i}_y \frac{1}{\epsilon_0}\left[\frac{\sigma_1}{2} - \frac{\rho_0 h}{\pi}\right],$$

$$\vec{E}_2 = 0,$$
$$\vec{E}_3 = \hat{i}_y \frac{1}{\epsilon_2}\left[\frac{\sigma_1}{2} - \frac{\rho_0 h}{\pi}\right],$$

$$\vec{E}_4 = -\hat{i}_y \frac{1}{\epsilon_2}\left[\frac{\sigma_1}{2} + \frac{\rho_0 h}{\pi}\right],$$

$$\vec{E}_5 = -\hat{i}_y \frac{1}{\epsilon_1}\left[\frac{\sigma_1}{2} + \frac{\rho_0 h}{\pi}\cos(\pi y/h)\right],$$

$$\vec{E}_6 = -\hat{i}_y \frac{1}{\epsilon_0}\left[\frac{\sigma_1}{2} - \frac{\rho_0 h}{\pi}\right],$$

(γ)

$$\begin{aligned}
\vec{f}_1 &= -\hat{i}_y \sigma_1 \frac{1}{\epsilon_2}\frac{\rho_0 h}{\pi}, \\
\vec{f}(y=2a) &= -\hat{i}_y \frac{1}{2\epsilon_2}\left[\frac{\sigma_1}{2} - \frac{\rho_0 h}{\pi}\right]^2, \\
\vec{f}(y=2a+b) &= +\hat{i}_y \frac{1}{2\epsilon_0}\left[\frac{\sigma_1}{2} - \frac{\rho_0 h}{\pi}\right]^2.
\end{aligned}$$

<u>Θϵμα 2</u>

(α)

$$\vec{H}_1 = -\frac{K_1}{2}\left[\hat{i}_z\cos\Phi - \hat{i}_x \sin\Phi\right] + \mathrm{a}K_0\cos\vartheta\left[\frac{(y-y_0)\hat{i}_z - (z-z_0)\hat{i}_y}{(y-y_0)^2 + (z-z_0)^2}\right],$$

$$\vec{H}_2 = +\frac{K_1}{2}\left[\hat{i}_z\cos\Phi - \hat{i}_x \sin\Phi\right] + \mathrm{a}K_0\cos\vartheta\left[\frac{(y-y_0)\hat{i}_z - (z-z_0)\hat{i}_y}{(y-y_0)^2 + (z-z_0)^2}\right],$$

$$\vec{H}_3 = +\frac{K_1}{2}\left[\hat{i}_z\cos\Phi - \hat{i}_x \sin\Phi\right] + \hat{i}_x K_0 \sin\vartheta.$$

(β)

$$W_m = \frac{1}{2}\mu_0\left[\left(\frac{K_1}{2}\right)^2 + K_0^2\sin^2\vartheta - K_0K_1\sin\vartheta\sin\Phi\right]\pi\mathrm{a}^2L$$

and the maxima or minima are given for

$$\begin{aligned}
\vartheta &= \frac{\pi}{2}, \\
\vartheta &= \sin^{-1}\left\{\frac{K_1\sin\Phi}{2K_0}\right\} \qquad \text{if} \quad K_1\sin\Phi < 2K_0.
\end{aligned}$$

(γ)

$$\vec{f}_1 = \frac{\mathrm{a}\mu_0 K_1 K_0\cos\vartheta}{(y_0+d)^2 + (z-z_0)^2}\left[\hat{i}_x(z-z_0)\sin\Phi + \hat{i}_y(y_0+d)\cos\Phi - \hat{i}_z(z-z_0)\cos\Phi\right],$$

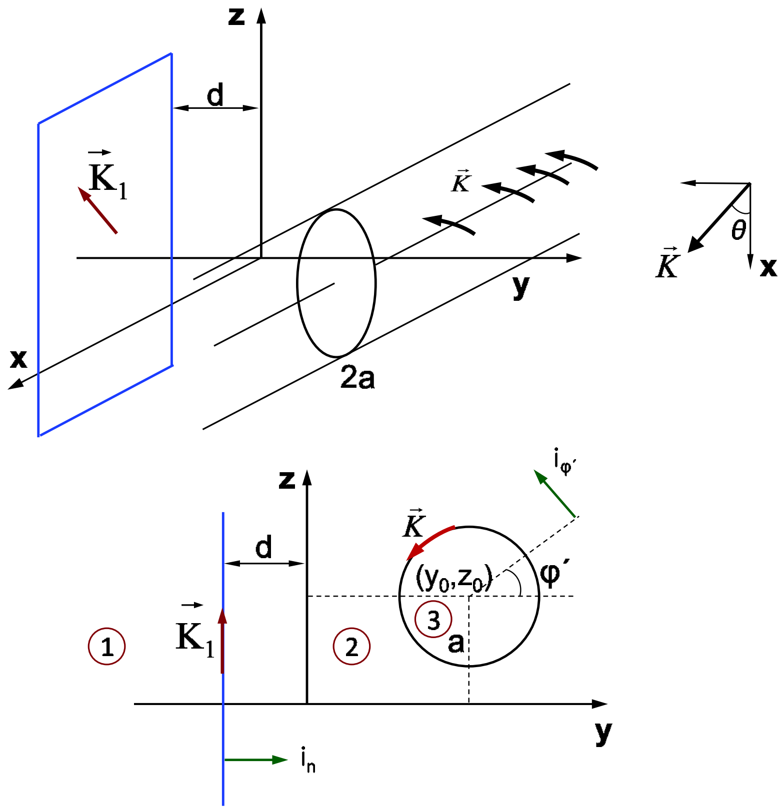

Figure 2: (Problem 2) Given structure geometry with specified (numbered) regions of interest.

$$\vec{f} \;=\; \hat{i}_y K_0 \mu_0 \left[\frac{K_0}{2} \cos(2\vartheta) - \frac{K_1}{2} \cos(\vartheta + \Phi) \right].$$

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

(α)

$$\vec{E}_1 \;=\; \hat{i}_x \left[E_0 \exp(-jk_0 z) + E_r \exp(+jk_0 z) \right],$$

$$\vec{E}_2 \;=\; \hat{i}_x \left[E_{2+} \exp(-\alpha_2 z) \exp(-j\beta_2 z) + E_{2-} \exp(+\alpha_2 z) \exp(+j\beta_2 z) \right],$$

$$\alpha_2 \;=\; \omega \sqrt{\mu_0 \epsilon_2} \left\{ \frac{1}{2} \left[-1 + \left(1 + \left(\frac{\sigma_2}{\omega \epsilon_2} \right)^2 \right)^{1/2} \right] \right\}^{1/2},$$

$$\beta_2 \;=\; \omega \sqrt{\mu_0 \epsilon_2} \left\{ \frac{1}{2} \left[+1 + \left(1 + \left(\frac{\sigma_2}{\omega \epsilon_2} \right)^2 \right)^{1/2} \right] \right\}^{1/2},$$

$$\vec{E}_3 \;=\; 0.$$

(β)

$$\vec{H}_1 \;=\; \hat{i}_y \frac{1}{Z_0} \left[E_0 \exp(-jk_0 z) - E_r \exp(+jk_0 z) \right],$$

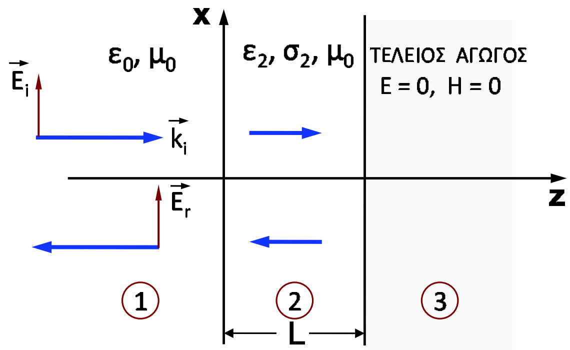

Figure 3: (Problem 3) Given structure geometry with specified (numbered) regions of interest.

$$
\begin{aligned}
Z_0 &= \sqrt{\frac{\mu_0}{\epsilon_0}}, \\
\vec{H}_2 &= \hat{i}_y \frac{1}{Z_2} \left[E_{2+} \exp(-\alpha_2 z) \exp(-j\beta_2 z) - E_{2-} \exp(+\alpha_2 z) \exp(+j\beta_2 z) \right], \\
Z_2 &= \sqrt{\frac{j\omega\mu_0}{\sigma_2 + j\omega\epsilon_0}}, \\
\vec{H}_3 &= 0.
\end{aligned}
$$

(γ)

$$
\begin{aligned}
E_0 + E_r &= E_{2+} + E_{2-}, \\
\frac{1}{Z_0} \left[E_0 - E_r \right] &= \frac{1}{Z_2} \left[E_{2+} - E_{2-} \right], \\
E_{2+} \exp(-j\beta_2 L) \exp(-\alpha_2 L) &+ E_{2-} \exp(+j\beta_2 L) \exp(+\alpha_2 L) = 0.
\end{aligned}
$$

$$
E_r = E_0 \frac{-(1+A) + (1-A)(Z_2/Z_0)}{(1+A) + (1-A)(Z_2/Z_0)},
$$

$$
\begin{aligned}
E_{2+} &= \frac{2E_0}{(1-A)+(1+A)(Z_0/Z_2)}, \\
E_{2-} &= \frac{-2AE_0}{(1-A)+(1+A)(Z_0/Z_2)}, \\
A &= \exp(-j\beta_2 L)\exp(-2\alpha_2 L).
\end{aligned}
$$

(δ)

$$
\vec{K} = \hat{i}_x \frac{2\exp(-j\beta_2 L)\exp(-\alpha_2 L)}{Z_2}\ \frac{2E_0}{(1-A)+(1+A)(Z_0/Z_2)}
$$

(ϵ)

$$
\begin{aligned}
\vec{f} &= \hat{i}_z \frac{2E_0^2}{Z_0^2}\mu_0 \cos^2(\omega t), \\
\langle \vec{f} \rangle &= \hat{i}_z \frac{E_0^2}{Z_0^2}\mu_0
\end{aligned}
$$