$\Theta\epsilon\mu\alpha$ 1

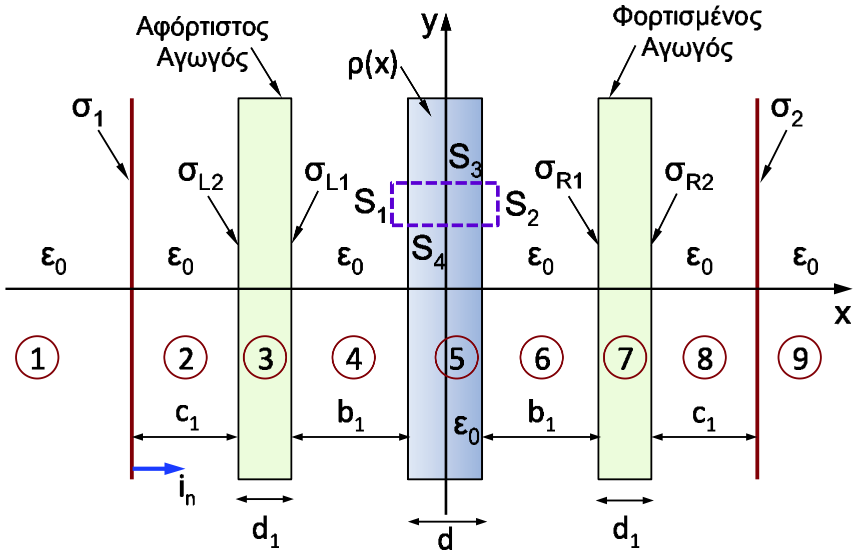

Figure 1: (Problem 1) Geometry of the structure under study with distinguished regions from 1 to 9.

(α)

$$\sigma_{L1} = -\frac{1}{2}\left[\sigma_2 - \sigma_1 + \frac{2\rho_0 d}{\pi} + q\right],$$

$$\sigma_{L2} = +\frac{1}{2}\left[\sigma_2 - \sigma_1 + \frac{2\rho_0 d}{\pi} + q\right],$$

$$\sigma_{R1} = +\frac{1}{2}\left[\sigma_2 - \sigma_1 - \frac{2\rho_0 d}{\pi} + q\right],$$

$$\sigma_{R2} = +\frac{1}{2}\left[\sigma_1 - \sigma_2 + \frac{2\rho_0 d}{\pi} + q\right].$$

(β)

$$\sigma_1 + \sigma_2 + q + \frac{2\rho_0 d}{\pi} = 0.$$

(γ)

$$\vec{f} = \frac{\rho_0 d}{\epsilon_0 \pi}(\sigma_1 - \sigma_2 - q)\hat{i}_x.$$

$\Theta\epsilon\mu\alpha$ 2

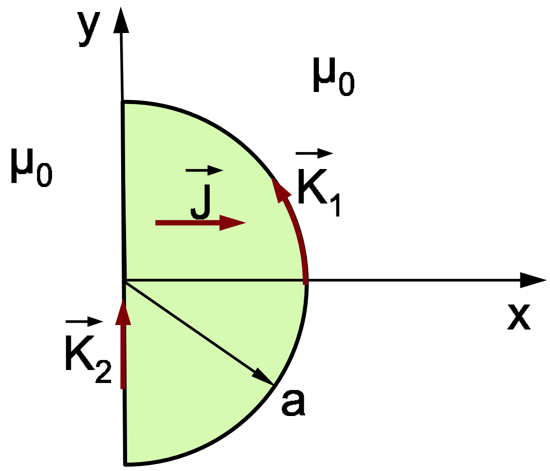

Figure 2: (Problem 2) Geometry of the structure under study.

(α)

$$\begin{aligned} \vec{K}_1(\phi) &= J_0 \mathrm{a}\,[1+\sin\phi]\,\hat{i}_\phi, \\ \vec{K}_2(y) &= -J_0(y+\mathrm{a})\hat{i}_y. \end{aligned}$$

(β)

$$\vec{H}(r_T,\phi) = \hat{i}_z \begin{cases} J_0\,[\mathrm{a}+r_T\sin\phi]\,, & \text{for } r_T < \mathrm{a} \;\text{ and }\; -\frac{\pi}{2} < \phi < \frac{\pi}{2}, \\ 0 & \text{elsewhere} \end{cases}$$

(γ)

$$\vec{f} = \hat{i}_{r_T}\frac{\mu_0}{2}J_0^2\mathrm{a}^2\,(1+\sin\phi)^2\,.$$

$\Theta\epsilon\mu\alpha$ 3

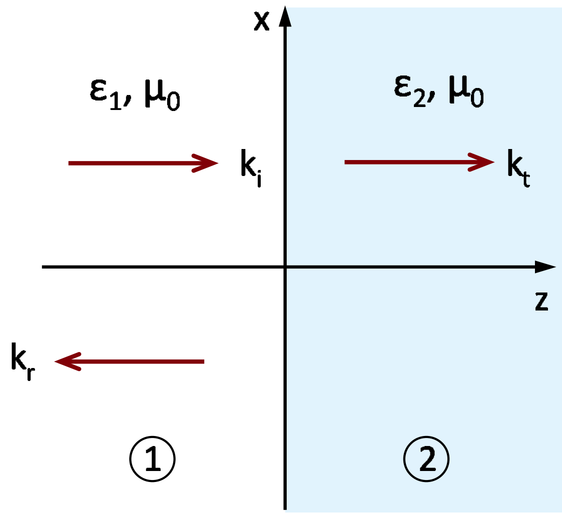

Figure 3: (Problem 3) Geometry of the two dielectrics interface.

(α)

$$
\begin{aligned}
r &= \frac{n_1 - n_2}{n_1 + n_2} = \frac{\sqrt{\epsilon_1} - \sqrt{\epsilon_2}}{\sqrt{\epsilon_1} + \sqrt{\epsilon_2}}, \\
t &= \frac{2n_1}{n_1 + n_2} = \frac{2\sqrt{\epsilon_1}}{\sqrt{\epsilon_1} + \sqrt{\epsilon_2}}, \\
k_i &= \omega\sqrt{\epsilon_i \mu_0}, \qquad i = 1, 2, \\
Z_i &= \sqrt{\frac{\mu_0}{\epsilon_i}}, \qquad i = 1, 2, \\
\vec{E}_r &= rE_0 \left[\hat{i}_x - j\hat{i}_y\right] \exp(+jk_1 z) \qquad LHCP \\
\vec{H}_r &= -\frac{rE_0}{Z_1} \left[j\hat{i}_x + \hat{i}_y\right] \exp(+jk_1 z) \\
\vec{E}_t &= tE_0 \left[\hat{i}_x - j\hat{i}_y\right] \exp(-jk_2 z) \qquad RHCP \\
\vec{H}_t &= \frac{tE_0}{Z_2} \left[j\hat{i}_x + \hat{i}_y\right] \exp(-jk_2 z).
\end{aligned}
$$

(β)

$$
\begin{aligned}
\langle \vec{N}_1 \rangle &= \frac{1}{2} \left(\frac{2|E_0|^2}{Z_1} \right) \left(1 - |r|^2\right) \hat{i}_z, \\
\langle \vec{N}_2 \rangle &= \frac{1}{2} \left(\frac{2|E_0|^2}{Z_2} \right) |t|^2 \hat{i}_z,
\end{aligned}
$$

$$\frac{P_r}{P_{inc}} = \frac{1}{9} = 11.11\%,$$
$$\frac{P_t}{P_{inc}} = \frac{8}{9} = 88.89\%.$$

(γ)

$$\vec{f} = \hat{i}_z \left(\frac{2|E_0|^2}{2}\right)\left[\epsilon_1(1+r^2) - \epsilon_2 t^2\right],$$
$$\vec{f} = -\hat{i}_z 5.9 pN/m^2.$$