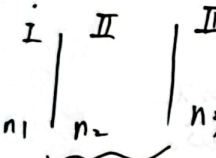
7.2



$k_2 = \frac{n_2}{c}\omega$.

$r = r_{12} + t_{12}r_{23}t_{21}e^{2ik_2d} + t_{12}r_{23}r_{21}t_{21}e^{4ik_2d} + \cdots$

$= r_{12} + t_{12}r_{23}t_{21}e^{2ik_2d}\left(1 + r_{23}r_{21}e^{2ik_2d} + (r_{23}r_{21}e^{2ik_2d})^2 + \cdots\right)$

$= r_{12} + t_{12}r_{23}t_{21}e^{2ik_2d} \cdot \frac{1}{1 - r_{23}r_{21}e^{2ik_2d}}$

$r_{ij} = \frac{n_i - n_j}{n_i + n_j} = \frac{k_i - k_j}{k_i + k_j}$. $t_{ij} = \frac{2n_i}{n_i + n_j} = \frac{2k_i}{k_i + k_j}$.

$\rightarrow r_{12} = -r_{21}$. $t_{12}t_{21} = 1 + r_{12}r_{21} = 1 - r_{12}^2$.

$r = \frac{r_{12} + r_{23}e^{2ik_2d}}{1 + r_{12}r_{23}e^{2ik_2d}}$

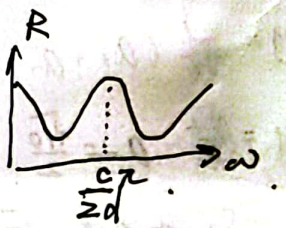
$R = r^2 = \frac{r_{12}^2 + r_{23}^2 + 2r_{12}r_{23}\cos 2k_2d}{1 + 2r_{12}r_{23}\cos 2k_2d + r_{12}^2r_{23}^2}$.

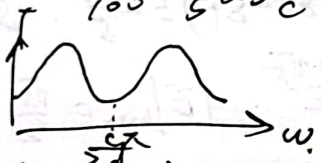
$T = 1 - R = \frac{1 - r_{12}^2 - r_{23}^2 + r_{12}^2r_{23}^2}{1 + 2r_{12}r_{23}\cos 2k_2d + r_{12}^2r_{23}^2}$

① $n_1 = 1, n_2 = 2, n_3 = 3$: $r_{12} = -\frac{1}{3}$. $r_{23} = -\frac{1}{5}$. $k_2 = \frac{2}{c}\omega$.

$R = \frac{\frac{1}{4} + \frac{1}{25} + \frac{1}{5}\cos\frac{4}{c}d\omega}{1 + \frac{1}{5}\cos\frac{4}{c}d\omega + \frac{1}{100}} = 1 - \frac{\frac{101}{100}}{\frac{101}{100} + \frac{1}{5}\cos\frac{4}{c}d\omega}$

$T = \frac{1 - \frac{1}{4} - \frac{1}{25} - \frac{1}{5}\cos\frac{4}{c}d\omega}{1 + \frac{1}{5}\cos\frac{4}{c}d\omega + \frac{1}{100}}$

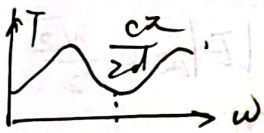




② $n_1 = 3, n_2 = 2, n_1 = 1$. $r_{12} = \frac{1}{5}$. $r_{23} = \frac{1}{3}$. $k_2 = \frac{2}{c}\omega$.

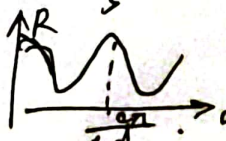
R 与 T 同上. R

T

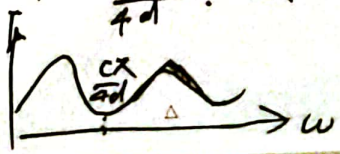


③ $n_1 = 2, n_2 = 4, n_3 = 1$ $r_{12} = -\frac{1}{3}$. $r_{23} = \frac{3}{5}$. $k_2 = \frac{4}{c}\omega$.

$R = \frac{\frac{1}{9} + \frac{9}{25} - \frac{2}{5}\cos\frac{8}{c}d\omega}{1 - \frac{2}{5}\cos\frac{8}{c}d\omega + \frac{1}{25}}$



$T = \frac{1 - \frac{1}{9} - \frac{9}{25} + \frac{2}{5}\cos\frac{8}{c}d\omega}{1 - \frac{2}{5}\cos\frac{8}{c}d\omega + \frac{1}{25}}$



10). $R=0$. $r_{12}+r_{23}e^{2ik_2d}=0$.

$$\frac{n_1-n_2}{n_1+n_2}+\frac{n_2-1}{n_2+1}e^{2ik_2d}=0 \quad = \frac{n_1n_2+n_1-n_2^2-n_2}{(n_1+n_2)(n_2+1)} + n_1n_2e^{i\varphi}+n_2^2e^{i\varphi}-n_1e^{i\varphi}-n_2e^{i\varphi}$$

$\rightarrow n_1n_2(1+e^{i\varphi})+n_1(1-e^{i\varphi})+n_2^2(e^{i\varphi}-1)+n_2(1+e^{i\varphi})=0$

$(n_1n_2-n_2)(1+e^{i\varphi})+(n_1-n_2^2)(1-e^{i\varphi})=0$

1: $n_1=1$. $\varphi=2m\pi = 2k_2d$. $\rightarrow d=\frac{m\pi}{k_2}=\frac{cm\pi}{n_2\omega_0}$

2: $\varphi=(2m+1)\pi$. $n_2=\sqrt{n_1}$. $n_2d=\frac{cm\pi}{\omega_0}$. $m=1,2,..$

$d=\frac{(2m+1)\pi}{2k_2}=\frac{c(2m+1)\pi}{2n_2\omega}=\frac{c(2m+1)\pi}{2\sqrt{n_1}\omega}$. $m=0,1,2,\dots$

7.1.

$E_+=a_+e^{i\delta_+}$. $a_+=\sqrt{\frac{S_0+S_3}{2}}$. $E_-=a_-e^{i\delta_-}$. $a_-=\sqrt{\frac{S_0-S_3}{2}}$.

$\vec{\varepsilon}_\pm=\frac{1}{\sqrt{2}}(\vec{\varepsilon}_1\pm i\vec{\varepsilon}_2)$

$\vec{E}=Re\left[(\vec{\varepsilon}_+E_++\vec{\varepsilon}_-E_-)e^{i\vec{k}\cdot\vec{x}-i\omega t}\right]$ $\phi_1=\delta_1+\vec{k}\cdot\vec{x}-\omega t$.

$=\frac{1}{\sqrt{2}}[\vec{\varepsilon}_1a_+\cos\phi_1+\vec{\varepsilon}_1a_-\cos(\phi_1+\delta_--\delta_+)]+\frac{1}{\sqrt{2}}[\vec{\varepsilon}_2a_+\sin\phi_1+\vec{\varepsilon}_2a_-\sin(\phi_1+\delta_--\delta_+)]$

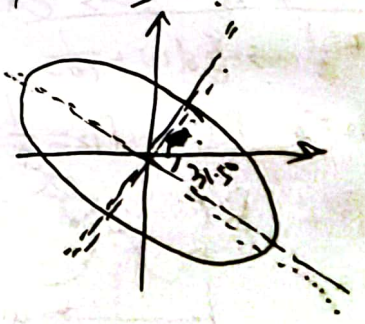
$|\vec{E}|=\frac{1}{\sqrt{2}}\sqrt{a_+^2+a_-^2+2a_+a_-\cos(2\phi_1+\delta_--\delta_+)}$. $|\vec{E}|_{max}$时, $\phi_1=\frac{1}{2}(\delta_+-\delta_-)$.

$E_x=|\vec{E}|_{max}\cos\frac{\delta}{2}=\frac{1}{\sqrt{2}}(a_++a_-)\cos\frac{1}{2}(\delta_--\delta_+)$

$E_y=\frac{1}{\sqrt{2}}(a_++a_-)\sin\frac{1}{2}(\delta_--\delta_+)$

(a). $a_+=\frac{\sqrt{2}}{2}$. $a_-=\frac{\sqrt{10}}{2}$. $\cos(\delta_--\delta_+)=-\frac{\sqrt{5}}{5}$. $\sin(\delta_--\delta_+)=\frac{2\sqrt{5}}{5}$.

$\delta_--\delta_+\approx 63.4°$ $|\vec{E}|_{max}=\frac{1+\sqrt{5}}{2}$. $|\vec{E}|_{ms}=\frac{\sqrt{15}}{5}$.



(b). $a_+=4$. $a_-=3$. $\cos(\delta_--\delta_+)=0$. $\sin(\delta_--\delta_+)=1$

$\delta_--\delta_+=90°$. $|E|_{max}=\frac{7\sqrt{2}}{2}$. $|E|_{ms}=\frac{\sqrt{2}}{2}$.