a) Explique pq razão o dipolo de $\lambda/2$ é o mais popular

calcule a densidade de potência média, potência de radiação.

e indique sem calcular a expressão da potência irradiada por este dipolo

diagrama de radiação

b) Determine a grandeza de l/λ, para que apresente um diagrama Trilobular

C) De que forma é afetado o campo eletromagnético criado pelo Dipolo na presença de um plano condutor infinito

D) Que topologia de antena cria o mesmo campo eletromagnético e apresenta a antena quando aquela se encontra num ~~pl~~ P.C.I

E) Determine a relação entre resistência de radiação de ambos

($\frac{\lambda}{2}$ e

E) - sem obstáculos

- condutor infinito

- horizontal VS vertical

$$\text{ii)}\quad \vec{S} = \frac{1}{2}\cdot\vec{E_1}\cdot\vec{H} = \frac{1}{2}\begin{vmatrix} \hat{r} & \theta & \varphi \\ 0 & E_\theta & 0 \\ 0 & 0 & H_\varphi \end{vmatrix} = \frac{1}{2}\,\vec{E_\theta}\cdot H_\varphi = \frac{1}{2\eta}\cdot E_\theta^2$$

$l = \lambda/2$

$$k = \frac{2\pi}{\lambda} = \frac{2\pi}{\frac{l}{2}}$$

$$|\vec{S_r}| = \frac{1}{2\eta}\cdot\frac{\eta^2 I_0^2}{4\pi^2 r^2}\left(\frac{\cos\left(\frac{kl}{2}\cdot\cos\theta\right) - \cos\left(\frac{kl}{2}\right)}{\sin\theta}\right)^2$$

$$\frac{kl}{2} = \frac{\frac{2\pi}{\lambda}\times l}{2} = \frac{\frac{2\pi}{\cancel{\lambda}}\times\frac{\cancel{\lambda}}{2}}{2} = \frac{\pi}{2}$$

$$|\vec{S_r}| = \frac{1}{2}\cdot\frac{\eta\, I_0^2}{4\pi^2 r^2}\cdot\left(\frac{\cos\left(\frac{\pi}{2}\cdot\cos\theta\right) - 0}{\sin\theta}\right)^2$$

$$U = \vec{S_r}\cdot r^2 = \eta\cdot\frac{I_0^2}{8\pi^2}\cdot\left(\frac{\cos\left(\frac{\pi}{2}\cdot\cos\theta\right)}{\sin\theta}\right)^2$$

$$W = \iint \mathrm{Re}\{S_r\}\,ds_r = \iint_S \mathrm{Re}\{S_r\}\cdot r^2\cdot\sin\theta\cdot d\theta\cdot d\varphi$$

$$= \eta\cdot\frac{I_0^2}{8\pi^2}\cdot\int_0^{2\pi}\int_0^{\pi}\frac{\left(\cos\left(\pi/2\cdot\cos\theta\right)\right)^2}{\sin\theta}\cdot d\theta\, d\varphi$$

$$= \eta\cdot\frac{2\pi\cdot I_0^2}{8\pi^2}\int_0^{\pi}\frac{\cos^2\left(\pi/2\cdot\cos\theta\right)}{\sin\theta} = \eta\cdot\frac{I_0^2}{4\pi}\cdot\int_0^{\pi}\frac{\cos^2\left(\pi/2\cdot\cos\theta\right)}{\sin\theta}\cdot d\theta$$

diagrama de radiação

zeros:

$\cos\left(\frac{\pi}{2} \cdot \cos\theta\right) = 0 \qquad \wedge \qquad \sin\theta = 0$

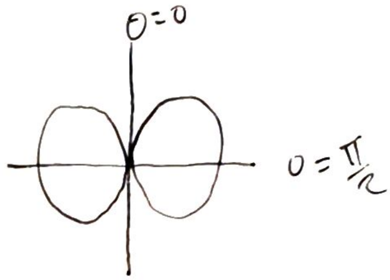
$\frac{\pi}{2}\cos\theta = \pm\frac{\pi}{2} \pm m\pi$

$\cos\theta = \pm 1 \pm \frac{m\pi}{\frac{\pi}{2}} \left(= 2m\right)$

$\cancel{\cos\theta} =$

$\theta_0 = \arccos(1) = 0$

$\arccos(-1) = \pi$



$\theta_1 = \arccos(1-2) = \pi$

$\arccos(-1+2) = 0$

$\sin\theta = 0 \rightarrow$ L'Hôpital

dipolo $\frac{\lambda}{2} \Rightarrow R = 75\,\Omega$

cond de max eficiência

$\lim_{\theta \to 0} \frac{(\cos(\frac{\pi}{2}\cdot\cos\theta))'}{(\sin\theta)'} = \frac{-(\frac{\pi}{2}\cdot\cos\theta)'\cdot\sin(\frac{\pi}{2}\cdot\cos\theta)}{\cos\theta} = \frac{\frac{\pi}{2}\cdot\sin\theta\cdot\sin(\frac{\pi}{2}\cdot\cos\theta)}{\cos\theta}$

$\lim_{\theta \to 0} \frac{0}{1} = 0$ então é zero

b) gomo l/λ -> Trilobular

Zeros

$$\cos\left(\frac{Kl}{2}\cdot\cos\theta\right)=\cos\left(\frac{Kl}{2}\right) \quad \wedge \quad \sin\neq 0$$

$$\frac{Kl}{2}\cdot\cos\theta = \pm\frac{Kl}{2}\pm 2m\pi$$

$$\cos\theta=\pm 1\pm\frac{2m\pi}{\frac{Kl}{2}}\left(=\frac{2m\pi}{\frac{\frac{2\pi}{\lambda}\cdot l}{2}}=\frac{2m\pi}{\frac{4\pi l}{\lambda}}=\frac{2m\pi\lambda}{4\pi l}=\frac{2m\lambda}{l}\right)$$

$m=0 \Rightarrow \theta=0 \;,\; \theta=\pi$

$m=1 \Rightarrow \theta_1=\arccos\left(\pm 1\pm\frac{2\lambda}{l}\right)$

$$\left[1-\frac{2\lambda}{l}>-1\right]$$

$\cos\theta$ $[+->-1]$

$[-+<1]$

$\sin\theta$ $[+->0]$

$[-+<1]$

$m=2 \Rightarrow \theta_2=\arccos\left(\pm 1\pm\frac{4\lambda}{l}\right)$ -> como não queremos

$$\left[1-\frac{4\lambda}{l}<-1\right] \quad \text{Tiram os limites}$$

$-1-\frac{2\lambda}{l}>-1 \Leftrightarrow -\frac{2\lambda}{l}>-2 \Leftrightarrow \frac{2\lambda}{l}<2 \Leftrightarrow \frac{\lambda}{l}<1 \Leftrightarrow$

$1-\frac{2\lambda}{l}<-1 \Leftrightarrow -\frac{2\lambda}{l}<-2 \Leftrightarrow \frac{2\lambda}{l}>2 \Leftrightarrow \frac{\lambda}{l}>1$

$$1<\frac{l}{\lambda}<2$$

$$P_n = \frac{W}{\frac{1}{2}\cdot I_0^2} \qquad c/ \quad W = \iint_S Re\{S_R\}\, dS_n$$

$W_{\lambda/2} = 2\,W_{\lambda/4}$ pq. $Re\{S_n\}$ = ambos os casos

$$W_{\frac{\lambda}{2}} = \int_0^{2\pi}\int_0^{\pi} Re\{S_n\}\, dS_n \quad /$$

$$P_n(\lambda/2) = \frac{W_{\lambda/2}}{\frac{1}{2}\cdot I_0^2} = \frac{2\,W_{\lambda/4}}{\frac{1}{2}\cdot I_0^2} = \frac{4\cdot W_{\lambda/4}}{I_0^2} = 2\,P_n\left(\frac{\lambda}{4}\right)$$