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16/10/17

Escuela Politécnica Superior

Asignatura Prop y Trans... PRUEBA 1

Nombre y Apellidos

Fecha Curso Grupo

(1) $\Omega_A = \int_0^{2\pi} \int_0^{\pi/2} \cos^2\theta \operatorname{sen}\theta \, d\theta \, d\phi$

$= \int_0^{2\pi} \left[-\frac{\cos^3\theta}{3} \right]_0^{\pi/2} d\phi = \frac{1}{3} \cdot 2\pi = \frac{2\pi}{3} \ [sr]$

$D = \frac{4\pi}{\Omega_A} = 4\pi \left(\frac{3}{2\pi} \right) = 6.$

$S = 3 = \frac{1+|\Gamma|}{1-|\Gamma|}$ $\quad 3 - 3|\Gamma| = 1 + |\Gamma|$

$2 = 4|\Gamma| \quad |\Gamma| = \frac{2}{4} = \frac{1}{2}$

$e_r = 1 - \left(\frac{1}{2}\right)^2 = \frac{3}{4}$

$G = e_r \cdot e_{cd} \, D = \frac{3}{4} \cdot 0{,}87 \cdot 6 \simeq 3{,}915$

$10 \log_{10} G = 5{,}927 \ dB.$

(2) $10^{\frac{S}{10}} = D \qquad D \simeq 3{,}16$

$\frac{P_{rad}}{4\pi R^2} \cdot D = \frac{1}{2} \frac{|E|^2}{\eta}$

$P_{rad} = \frac{1}{2} \frac{|0{,}1948|^2}{120\pi} \cdot \frac{4\pi \cdot (10 \cdot 10^3)^2}{10^{\frac{5}{10}}} = \frac{1}{2} \frac{|0{,}1948|^2}{120\pi} \cdot \frac{4\pi \cdot 1}{3{,}16}$

$= \frac{476856{,}84}{120\pi \cdot 3{,}16} = 20014{,}26 \ W \simeq 20 \ kW.$

Papel ecológico.

③ Radar primer prototipo MIT SCR - 584 2,7 - 2,9 GHz

Calentamiento de alimentos 2,45 GHz ISM

Terapias de calor reuma, artritis 915 MHz, 2,45 GHz

Tratamiento del cáncer, diatermia de microondas
hipertermia 915 MHz, 2,45 GHz.

Aceleradores de partículas, tubo de onda progresiva.
Radioastronomía
Espectroscopía.

Calentamiento de plasma, dispositivos fusión 3,7 GHz
110 GHz.

GPS 1575 MHz Galileo 1164 - 1215 MHz

Trazabilidad radio., control ganado, etc.

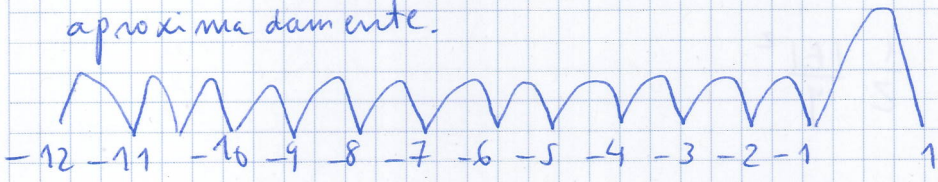
④ $\cos 30° = \frac{\sqrt{3}}{2}$ $\quad u = k \frac{L}{2} \left(\cos\theta - \frac{\sqrt{3}}{2} \right)$

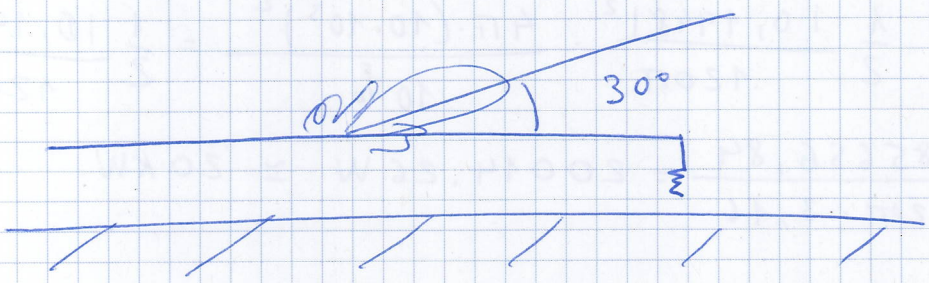
$\theta \in [0, \pi]$ $\quad u = \frac{2\pi}{\lambda} \cdot \frac{L}{2} \left(\cos\theta - \frac{\sqrt{3}}{2} \right)$

$\left[-1,86\pi \frac{L}{\lambda}, \; , \; \pi \frac{L}{\lambda} 0,13 \right]$

$L = 6,5\lambda$ $\quad [-12\pi, -11\pi, -10\pi, \ldots, 0,85\pi]$

aproximadamente.





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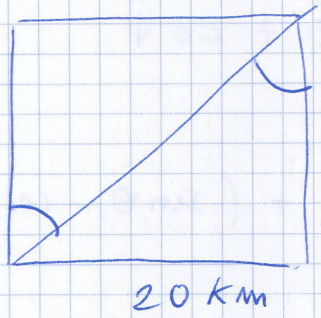
(5) $f = 6{,}85\ GHz \quad \lambda_0 = \frac{c}{f} = \frac{3\cdot 10^8}{6{,}85\cdot 10^9} = 0{,}04379\ m.$

$P_t = 120\ W \quad 10\log_{10} 120 = 20{,}79\ dB$

$10\log_{10} 0{,}92 = -0{,}362$

$D = 24\ dBi \quad 10^{\frac{24}{10}} = 251{,}1886$



$\text{arctg}\ \frac{20}{37{,}5} \simeq 28{,}07° \Rightarrow 0{,}49$

$\cdot \text{sen}^2(28°) = 0{,}22.$

$R = 42500\ m = 42{,}5\ km.$

$\left(\frac{\lambda_0}{4\pi R}\right) = 8{,}20\cdot 10^{-8} \quad \left(\frac{\lambda_0}{4\pi R}\right)^2 = 6{,}72\cdot 10^{-15} \Rightarrow -141{,}72\ dB$

$\frac{3}{2}\text{sen}^2 28° = \frac{33}{100} \Rightarrow -4{,}814\ dB \quad \left|\hat{\theta}\cdot\frac{9\hat{\theta}+2\hat{\varphi}}{\sqrt{85}}\right|^2 = \left|\frac{9}{\sqrt{85}}\right|$

$= \frac{81}{85} \Rightarrow -0{,}2093\ dB.$

En dB

$P_2 = 20{,}79 - 0{,}362 + 24 - 141{,}72 - 4{,}814 - 0{,}2093$

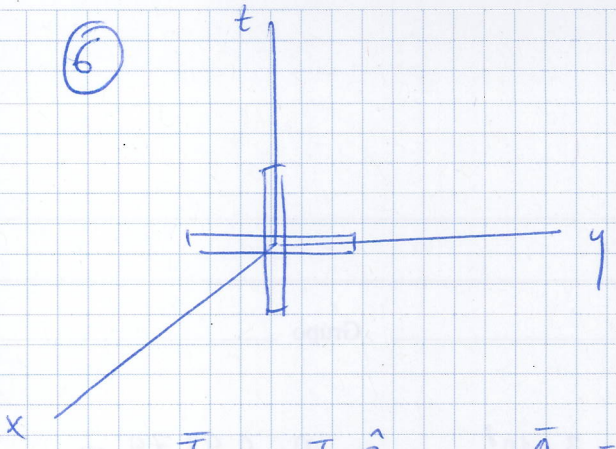
$= -102{,}3\ dB \Rightarrow 6{,}1\cdot 10^{-11}\ W$

$P_2 = 120\cdot 0{,}92\cdot 251{,}188\cdot 6{,}72\cdot 10^{-15}\cdot\frac{33}{100}\cdot\frac{81}{85}$

$\simeq 5{,}9\cdot 10^{-11}\ W \Rightarrow -102{,}29\ dB$

Papel ecológico.

(6)



$$\bar{I} = I_0 \hat{y}$$

$$\bar{A} = \frac{\mu_0}{4\pi} \int_{-L/2}^{L/2} I_0 \hat{y} \frac{e^{-jkr}}{2}$$

$$\hat{y} = \hat{\theta} \cos\theta \operatorname{sen}\phi + \hat{\phi} \cos\phi$$

$$\bar{I} = I_0 \hat{z} \qquad \bar{A} = \frac{\mu_0}{4\pi} \int_{-L/2}^{L/2} I_0 \hat{z} \frac{e^{-jkr}}{2}$$

$$\hat{z} = -\hat{\theta} \operatorname{sen}\theta.$$

$$\bar{E} = -j\omega \bar{A} = -\frac{j\omega\mu \angle I_0}{4\pi} \frac{e^{-jkr}}{2} \left[(-\operatorname{sen}\theta + \cos\theta \operatorname{sen}\phi)\hat{\theta} + \cos\phi \hat{\phi} \right] \text{ V/m.}$$

$$\bar{H}_{rad} = \frac{\hat{r} \times \bar{E}}{\eta_0} \quad \begin{vmatrix} \hat{r} & \hat{\theta} & \hat{\phi} \\ 1 & 0 & 0 \\ 0 & E_\theta & E_\phi \end{vmatrix} = -E_\phi \hat{\theta} + E_\theta \hat{\phi}$$

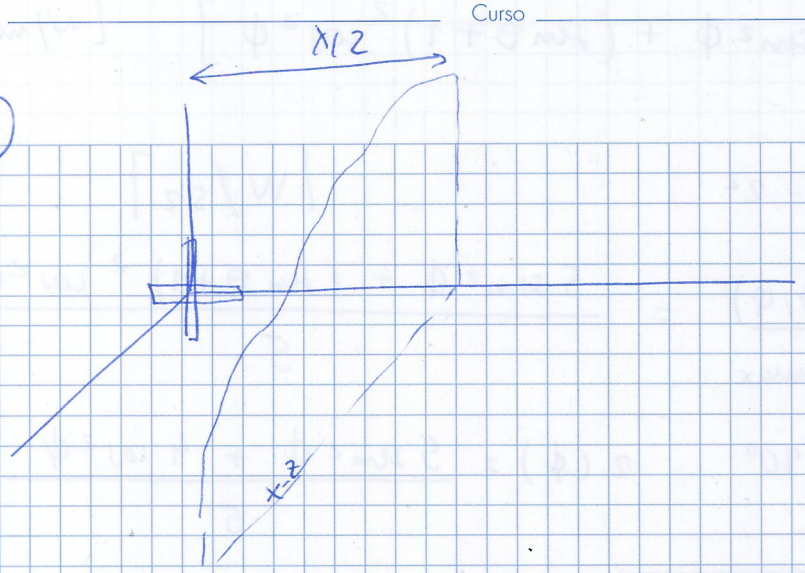
$$\bar{H}_{rad} = \frac{1}{\eta_0} \frac{\omega\mu \angle I_0}{4\pi} \frac{e^{-jkr}}{2} \left[\cos\phi \hat{\theta} + (\operatorname{sen}\theta - \cos\theta \operatorname{sen}\phi) \hat{\phi} \right] \text{ A/m.}$$

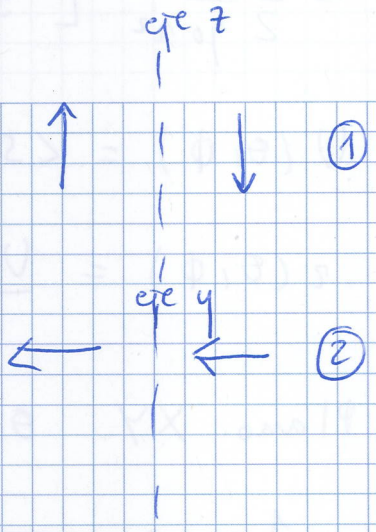
Pol

eje $\hat{y}$ $\theta = 90°$, $\phi = 90°$ $\quad \bar{E} = \hat{\theta}$ lineal.

eje $\hat{x}$ $\theta = 90°$, $\phi = 0°$ $\quad \bar{E} = \hat{\theta} + \hat{\phi}$ lineal a 45°

(7)





$\bar{r}_1 = -\frac{\lambda}{2}\hat{y}$ $\quad FA_1 = e^{jk\bar{r}_1\cdot\hat{r}} - e^{jk\bar{r}_2\cdot\hat{r}}$

$\bar{r}_2 = \frac{\lambda}{2}\hat{y}$ $\quad = e^{-j\frac{2\pi}{\lambda}\cdot\frac{\lambda}{2}\hat{y}\cdot\hat{r}} - e^{j\frac{2\pi}{\lambda}\cdot\frac{\lambda}{2}\cdot\hat{y}\cdot\hat{r}}$

$= e^{-j\pi \operatorname{sen}\theta \operatorname{sen}\phi} - e^{j\pi \operatorname{sen}\theta \operatorname{sen}\phi}$

$= 2j \operatorname{sen}(\pi \operatorname{sen}\theta \operatorname{sen}\phi)$ (Eje z)

$FA_2 = e^{jk\bar{r}_1\cdot\hat{r}} + e^{jk\bar{r}_2\cdot\hat{r}}$

$= 2\cos(\pi \operatorname{sen}\theta \operatorname{sen}\phi)$ (Eje y)

$\bar{E}_{total} = -\frac{j\omega\mu \angle I_0}{4\pi}\frac{e^{-jkz}}{2}\cdot[$

$2j \operatorname{sen}(\pi \operatorname{sen}\theta \operatorname{sen}\phi)(-\operatorname{sen}\theta)\hat{\theta} +$

$2\cos(\pi \operatorname{sen}\theta \operatorname{sen}\phi)(\cos\theta \operatorname{sen}\phi\,\hat{\theta} + \cos\phi\,\hat{\phi})]$ $\frac{V}{m}$

(8) $\vec{E}(r,\theta,\phi) = \left(\left(2+j \right) \operatorname{sen}\phi\, \hat{\theta} + e^{j\frac{\pi}{4}} \left(\operatorname{sen}\theta + 1 \right) \cos\phi\, \hat{\phi} \right) \frac{e^{-jkr}}{2}$

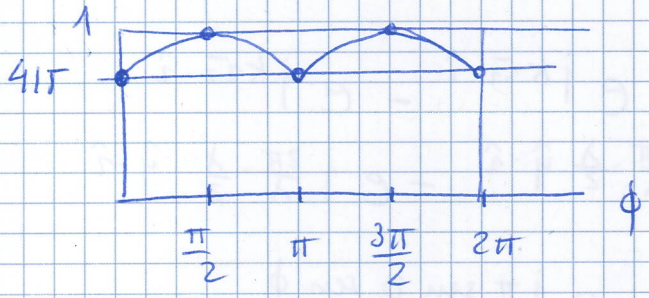
$\langle S \rangle = \frac{1}{2} \frac{|E|^2}{\eta_0} = \frac{1}{2\eta_0} \left(\vec{E} \cdot \vec{E}^* \right) =$

$= \frac{1}{2} \frac{1}{\eta_0 r^2} \left[5 \operatorname{sen}^2\phi + \left(\operatorname{sen}\theta + 1 \right)^2 \cos^2\phi \right]$ $\left[W/m^2 \right]$ vector $\hat{r}$

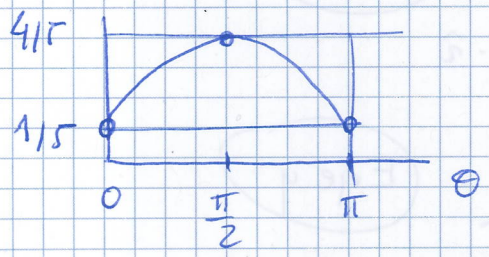
$U(\theta,\phi) = \langle S \rangle \cdot r^2$ $\left[W/sr \right]$

$z(\theta,\phi) = \frac{U(\theta,\phi)}{U_{max}} = \frac{5 \operatorname{sen}^2\phi + \left(\operatorname{sen}\theta + 1 \right)^2 \cos^2\phi}{5}$ adimensional

Plano XY $\theta = 90^\circ$ $z(\phi) = \frac{5 \operatorname{sen}^2\phi + 4 \cos^2\phi}{5}$



Plano XZ $\Rightarrow \phi = 0$ $z(\theta) = \frac{\left(\operatorname{sen}\theta + 1 \right)^2}{5}$



Plano YZ $\Rightarrow \phi = \pi/2$ 90° $z(\theta) = \frac{5}{5} = 1$