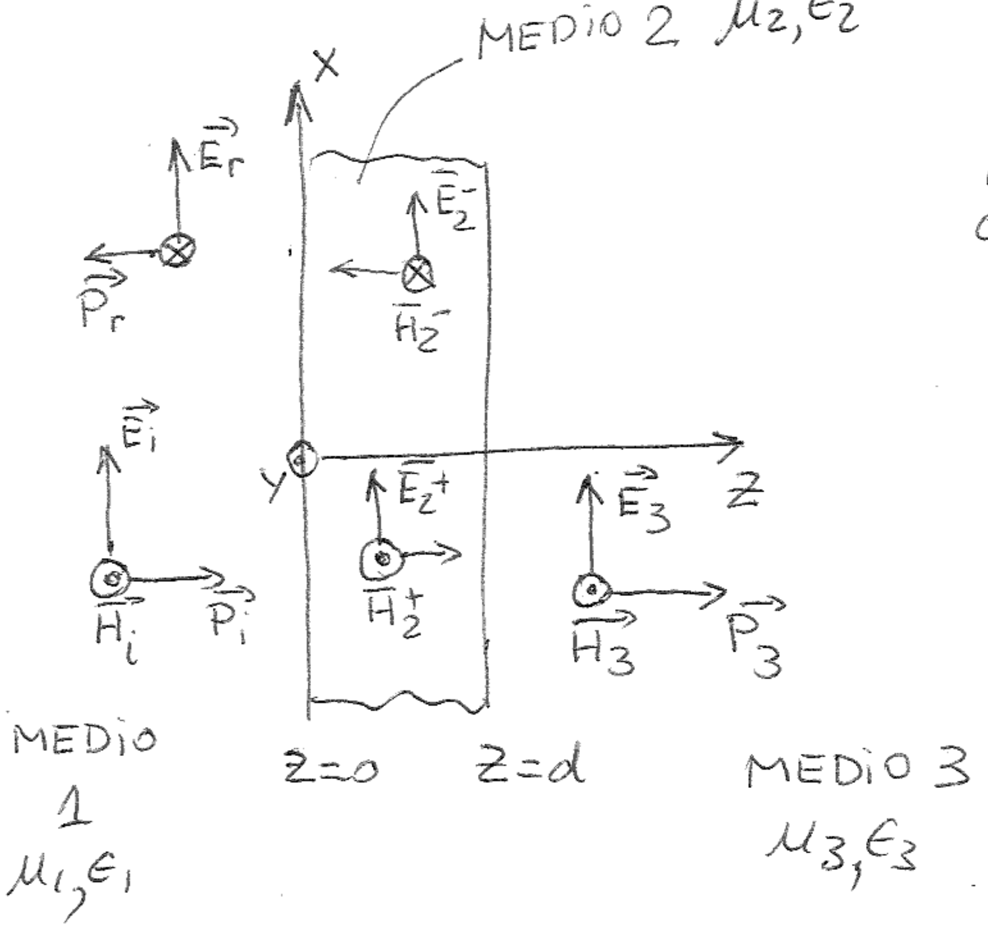


LAMINA DE CARAS PLANAS PARALELAS.

EL CAMPO ELÉCTRICO EN EL MEDIO 1

$$E_1 = \hat{x}\left(E_i e^{-j\beta_1 z} + E_r e^{j\beta_1 z}\right)$$

LA IMPEDANCIA DE ONDA EN ① SE DEFINE:

$$E_{1x}(z) = E_i\left(e^{-j\beta_1 z} + \Gamma e^{j\beta_1 z}\right)$$

$$H_{1y}(z) = \frac{E_i}{Z_1}\left(e^{-j\beta_1 z} - \Gamma e^{j\beta_1 z}\right)$$

CON UNA SOLA INTERFAZ EN Z=0.

$$Z_1(z) = \frac{E_{1x}}{H_{1y}} = \frac{Z_1\left(e^{-j\beta_1 z} + \Gamma e^{j\beta_1 z}\right)}{\left(e^{-j\beta_1 z} - \Gamma e^{j\beta_1 z}\right)}$$

$$Z_1(z)\Big|_{z=-l} = Z_1\left(\frac{e^{j\beta_1 l} + \Gamma e^{-j\beta_1 l}}{e^{j\beta_1 l} - \Gamma e^{-j\beta_1 l}}\right) \qquad \Gamma = \frac{Z_2 - Z_1}{Z_2 + Z_1}$$

$$= Z_1 \frac{\cos\beta_1 l + j\,\mathrm{sen}\,\beta_1 l + \Gamma\cos\beta_1 l - j\Gamma\,\mathrm{sen}\,\beta_1 l}{\cos\beta_1 l + j\,\mathrm{sen}\,\beta_1 l - \Gamma\cos\beta_1 l + j\Gamma\,\mathrm{sen}\,\beta_1 l}$$

$$= Z_1 \cdot \frac{(\cos\beta_1 l + j\,\mathrm{sen}\,\beta_1 l)(Z_2+Z_1) + (\cos\beta_1 l - j\,\mathrm{sen}\,\beta_1 l)(Z_2-Z_1)}{(\cos\beta_1 l + j\,\mathrm{sen}\,\beta_1 l)(Z_2+Z_1) + (-\cos\beta_1 l + j\,\mathrm{sen}\,\beta_1 l)(Z_2-Z_1)}$$

$$= Z_1 \cdot \frac{2 Z_2 \cos\beta_1 l + j\,\mathrm{sen}\,\beta_1 l \cdot 2 Z_1}{2 Z_1 \cos\beta_1 l + j 2 Z_2\,\mathrm{sen}\,\beta_1 l}$$

$$Z_1(z)\Big|_{z=-l} = Z_1 \cdot \left[\frac{Z_2 \cos\beta_1 l + j Z_1\,\mathrm{sen}\,\beta_1 l}{Z_1 \cos\beta_1 l + j Z_2\,\mathrm{sen}\,\beta_1 l}\right]$$

LA IMPEDANCIA EN EL MEDIO 2, SE PUEDE CALCULAR EN $z=0$, SE TRANSFORMAN LAS VARIABLES:

$l \rightarrow d$

$Z_2 \rightarrow Z_3$

$Z_1 \rightarrow Z_2$

$$Z_2(z)\Big|_{z=0} = Z_2 \cdot \left[\frac{Z_3 \cos\beta_2 d + j Z_2\,\mathrm{sen}\,\beta_2 d}{Z_2 \cos\beta_2 d + j Z_3\,\mathrm{sen}\,\beta_2 d}\right]$$

CONSIDERE EL COEF. DE REF. A LA ENTRADA:

$$\Gamma_0 = \frac{E_r}{E_i} = \frac{Z_2(0) - Z_1}{Z_2(0) + Z_1}$$

SI SE BUSCA $\Gamma_0 = 0 \Rightarrow Z_2(0) - Z_1 = 0$

$$Z_2\left(Z_3 \cos\beta_2 d + j Z_2\,\mathrm{sen}\,\beta_2 d\right) = Z_1\left(Z_2 \cos\beta_2 d + j Z_3\,\mathrm{sen}\,\beta_2 d\right)$$

$$\begin{cases} Z_3 \cos\beta_2 d = Z_1 \cos\beta_2 d & (1) \\ Z_2^2\,\mathrm{sen}\,\beta_2 d = Z_1 Z_3\,\mathrm{sen}\,\beta_2 d & (2) \end{cases}$$

SEPARANDO PARTES REALES E IMAGINARIAS

SE DEBEN CUMPLIR SIMULTANEAMENTE (1) Y (2):

DE (1)

$$Z_3 = Z_1$$

o

$$\cos \beta_2 d = 0$$

$$\beta_2 d = (2m+1)\frac{\pi}{2} \qquad m = 0,1,2\ldots$$

$$d = (2m+1)\frac{\lambda_2}{4}$$

DE (2)

$$Z_2 = \sqrt{Z_1 Z_3}$$

o

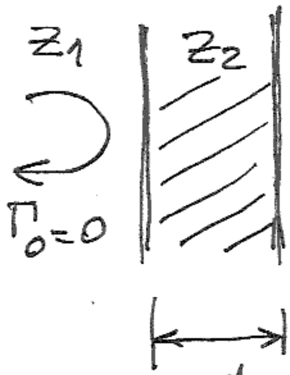
$$\operatorname{sen} \beta_2 d = 0$$

$$\beta_2 d = m\pi \qquad m = 0,1,2\ldots$$

$$d = \frac{\lambda_2 m}{2}$$

POR LO TANTO SE VA A TENER DOS SOLUCIONES

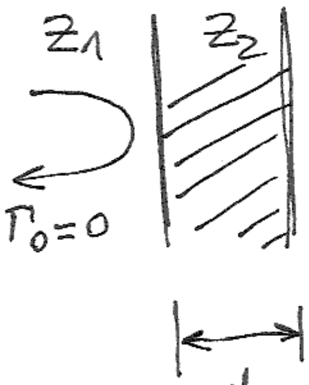
(a)



$$Z_3 = Z_1$$

$$d = \frac{m\lambda_2}{2} \qquad m = 0,1,2,\ldots$$

(b)



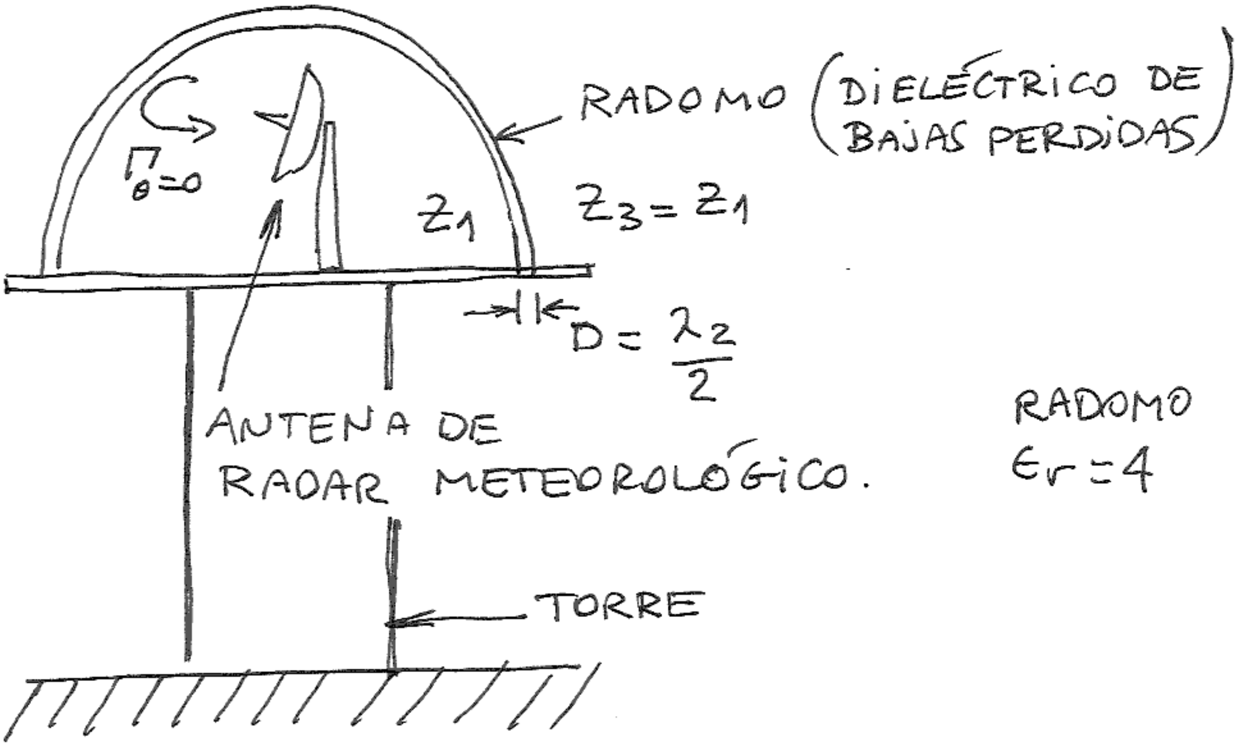
$$Z_3 \neq Z_1 \qquad Z_2 = \sqrt{Z_1 Z_3}$$

$$d = (2m+1)\frac{\lambda_2}{4} \qquad m = 0,1,2,\ldots$$

LAS LÁMINAS DE CARAS PARALELAS TIENEN. APLICACIONES EN ÓPTICA, DONDE SE APLICA UN RECUBRIMIENTO ANTIREFLECTANTE A LARGAVISTAS POR EJEMPLO.

TAMBIEN SE UTILIZAN EN RADOMOS, PARA PROTEGER ANTENAS DE RADAR METEOROLÓGICO O ANTENAS DE TELEFONÍA DE LAS INCLEMENCIAS DEL TIEMPO.

EJEMPLO



RADOMO
$\epsilon_r = 4$

SI EL RADAR METEOROLOGICO TIENE UNA SEÑAL DE $f = 5600\ MHz$

$$\lambda_0 = \frac{c}{f} = \frac{3 \cdot 10^8\ m/s}{5600 \cdot 10^6\ 1/s} = 5,35\ cm \qquad \lambda_2 = \frac{\lambda_0}{\sqrt{\epsilon_r}} = \frac{\lambda_0}{2}$$

$$D = \frac{\lambda_2}{2} = \frac{5,35}{2 \cdot 2}\ cm = 1,33\ cm$$

$\lambda_0 = \lambda$ EN EL AIRE

$\lambda_2 = \lambda$ EN EL DIELECTRICO.