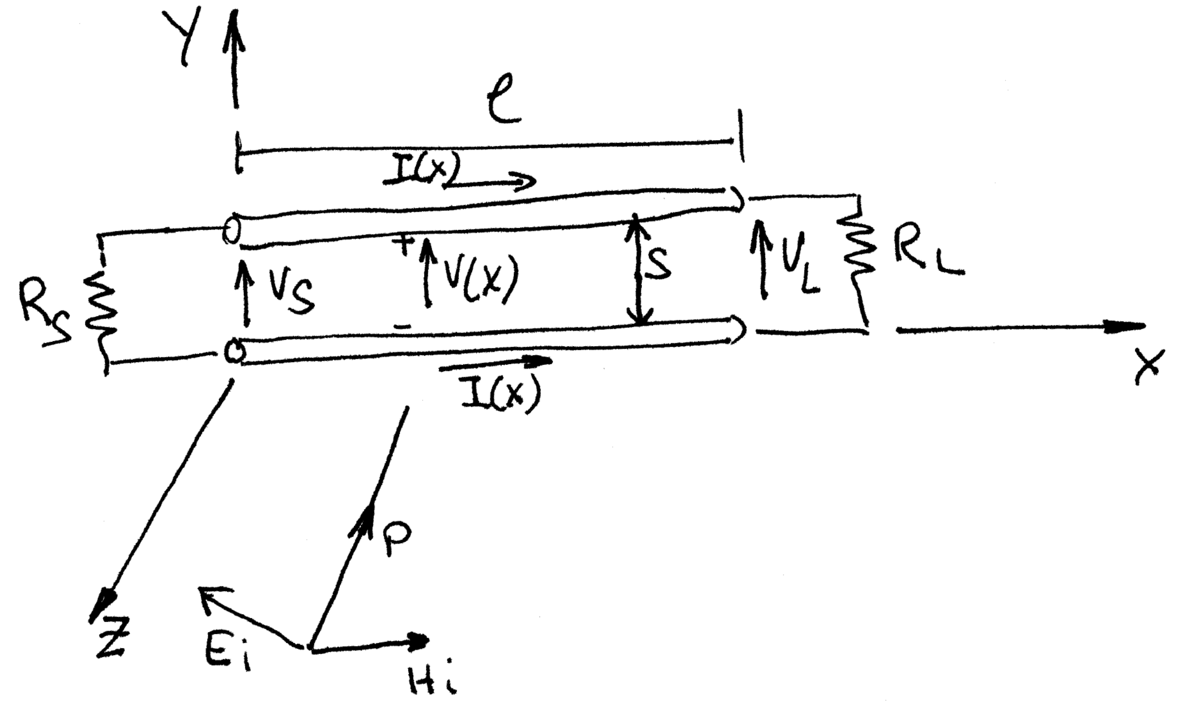
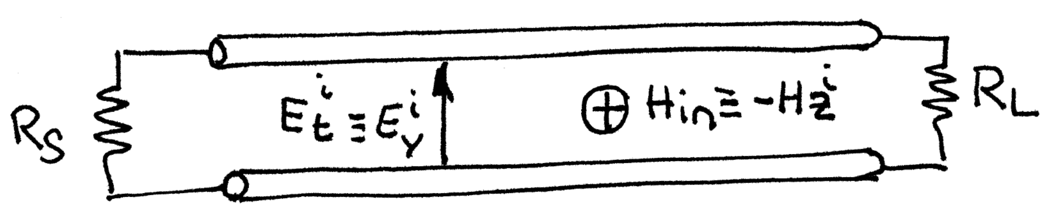
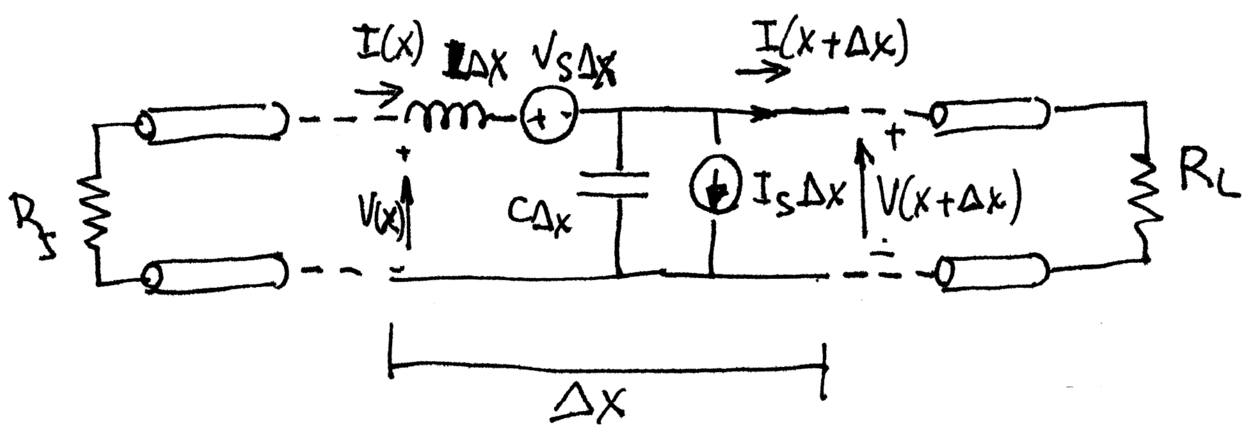




LAS DOS COMPONENTES DE LA ONDA INCIDENTE QUE CONTRIBUYEN A LA V INDUCIDA SON:

E_Y^i COMPONENTE TRANSVERSAL DE $\vec{E}$

H_Z^i COMPONENTE NORMAL DE $\vec{H}$



POR LEY DE FARADAY:

$$FEM = -\frac{d\phi}{dt}$$

$$FEM = -j\omega \int_{SUP} B_n^i \, ds$$

$$FEM = -j\omega \mu_0 \int_{SUP} H_n^i \, ds$$

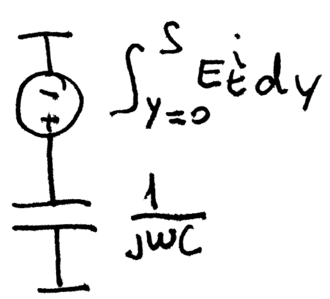
$$FEM = -j\omega \mu_0 \Delta x \int_{y=0}^{S} H_n^i \, dy$$

$$V_S = \frac{FEM}{\Delta x} = -j\omega \mu_0 \frac{\cancel{\Delta x}}{\cancel{\Delta x}} \cdot \int_{y=0}^{S} H_n^i \, dy$$

$$\frac{I(x)}{S} = \frac{\int_{y=0}^{S} E_t^i \, dy}{\frac{1}{j\omega C}}$$

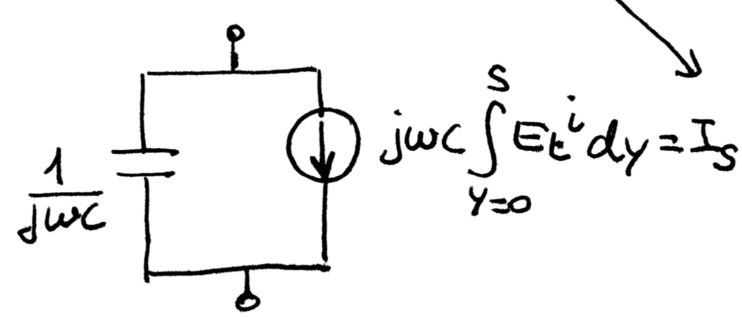
$\int_{y=0}^{S} E_t^i \, dy \leftarrow$ DIFERENCIA DE POTENCIAL DEBIDA A E_t^i

CORRIENTE INDUCIDA



THEVENIN

$=$



NORTON

DEL MODELO ELECTRICO

$$\begin{cases} V(x+\Delta x) - V(x) = -j\omega \ell \Delta x\, I(x) - V_S(x)\Delta x \\ I(x+\Delta x) - I(x) = -j\omega c \Delta x\, V(x+\Delta x) - I_S \Delta x \end{cases}$$

DIVIDIENDO POR Δx:

$$\begin{cases} \dfrac{V(x+\Delta x) - V(x)}{\Delta x} = -j\omega \ell\, I(x) - V_S(x). \\ \dfrac{I(x+\Delta x) - I(x)}{\Delta x} = -j\omega c\, V(x+\Delta x) - I_S(x) \end{cases}$$

HACIENDO $\Delta x \to 0$:

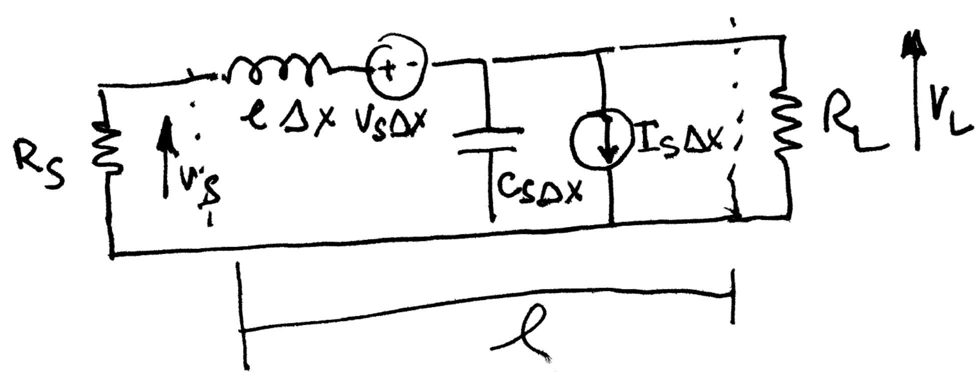
$$\begin{cases} \dfrac{dV(x)}{dx} + j\omega \ell\, I(x) = -V_S(x) = -j\omega \mu_0 \displaystyle\int_{y=0}^{s} H_n^i\, dy \\ \dfrac{dI(x)}{dx} + j\omega c\, V(x) = -I_S(x) = -j\omega c \displaystyle\int_{y=0}^{s} E_t^i\, dy \end{cases}$$

SI LA LÍNEA ES ELECTRICAMENTE CORTA $\ell \ll \lambda$

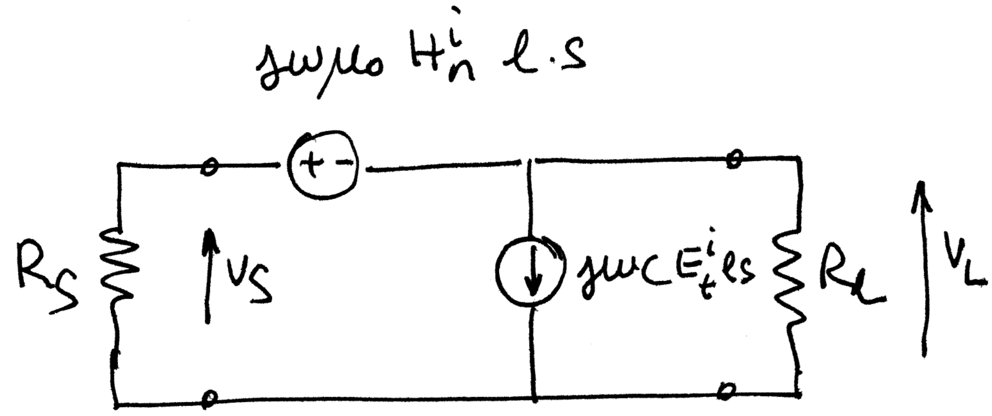
$$V_S \cdot \ell \cong -j\omega \mu_0 H_n^i \cdot \overbrace{\ell \cdot s}^{A}$$

$$\ell \cdot s = Area\,(A)$$

$$I_S \ell \cong -j\omega C E_t^i\, \overbrace{\ell \cdot s}^{A}$$



$\Delta x \equiv \ell$



$$V_S = \frac{R_S}{R_S+R_L}\, j\omega\mu_o l \cdot s\, H_n^i - \frac{R_S R_L}{R_S+R_L}\, j\omega c\, l s\, E_t^i$$

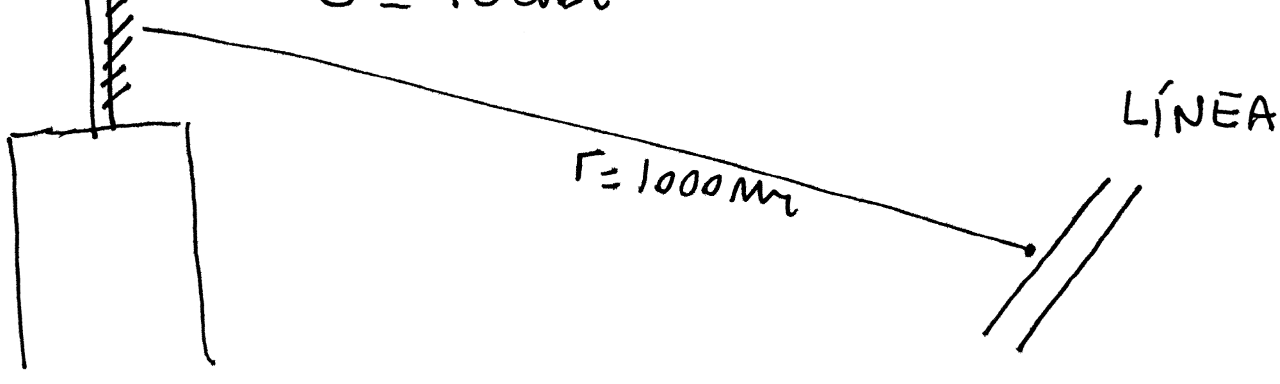
$$V_L = -\frac{R_L}{R_S+R_L}\, j\omega\mu_o l \cdot s\, H_n^i - \frac{R_S R_L}{R_S+R_L}\, j\omega c\, l \cdot s \cdot E_t^i$$

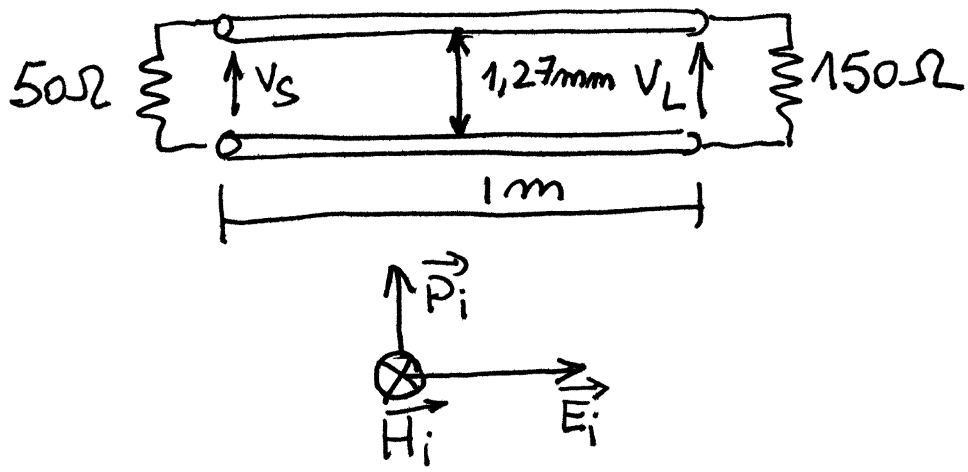
EJEMPLO:

CONSIDERE UN CABLE PLANO QUE POSEEN UNA SEPARACION DE 1,27 mm. LAS IMPEDANCIAS DE TERMINACION SON $R_S = 50\Omega$ Y $R_L = 150\Omega$ DE RADIO = 0,19 mm

ESTACION FM $f = 100\,MHz$ $W = 50\,KW$

$G = 10\,dBi$



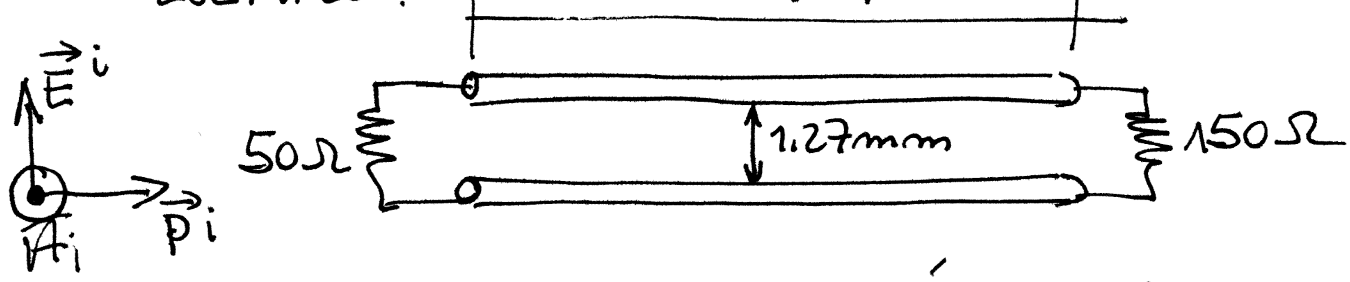


a) OBTENER EL CIRCUITO ELECTRICO EQUIVALENTE DE $V_{INDUCIDA}$

b) CALCULAR V_S y V_L.

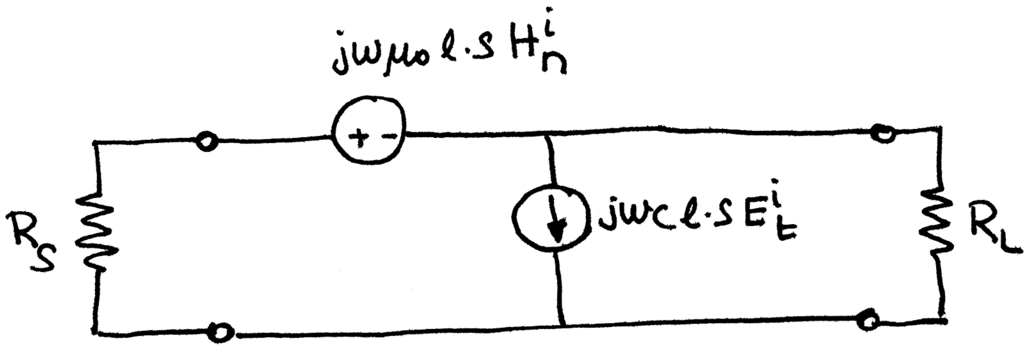
PARA RESOLVER EN CLASE

EJEMPLO:



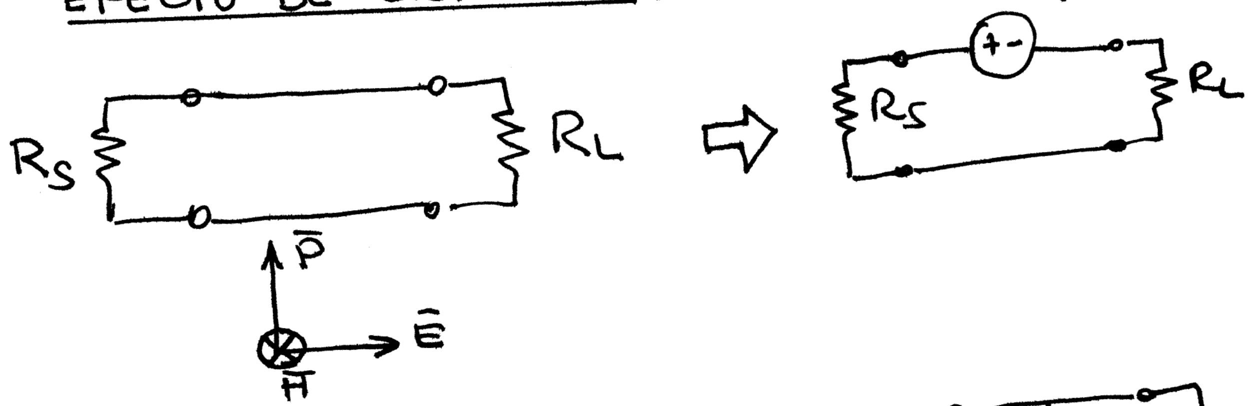
AHORA CAMBIA LA ORIENTACIÓN DE LA ONDA INCIDENTE.

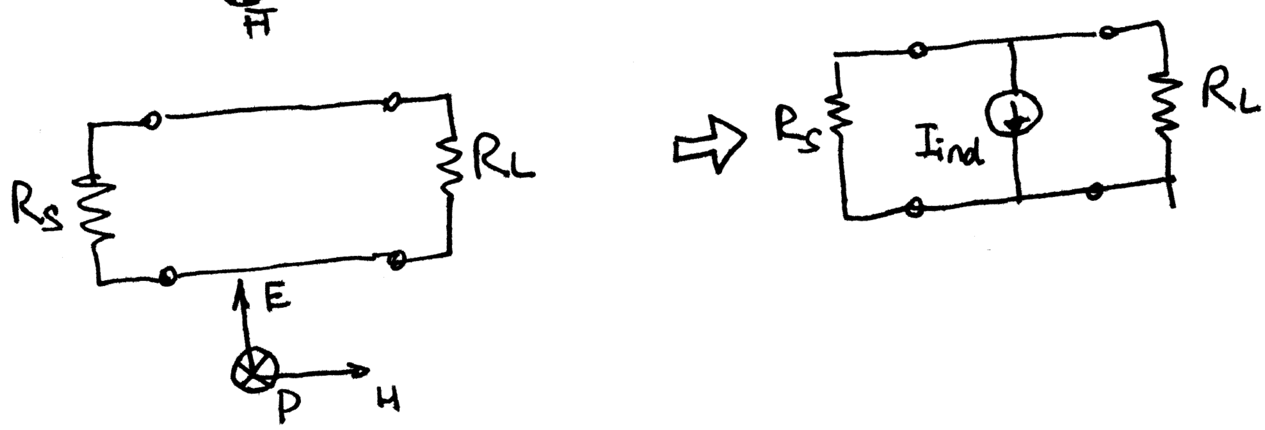
MODELO SIMPLIFICADO EQUIVALENTE ELECTRICO

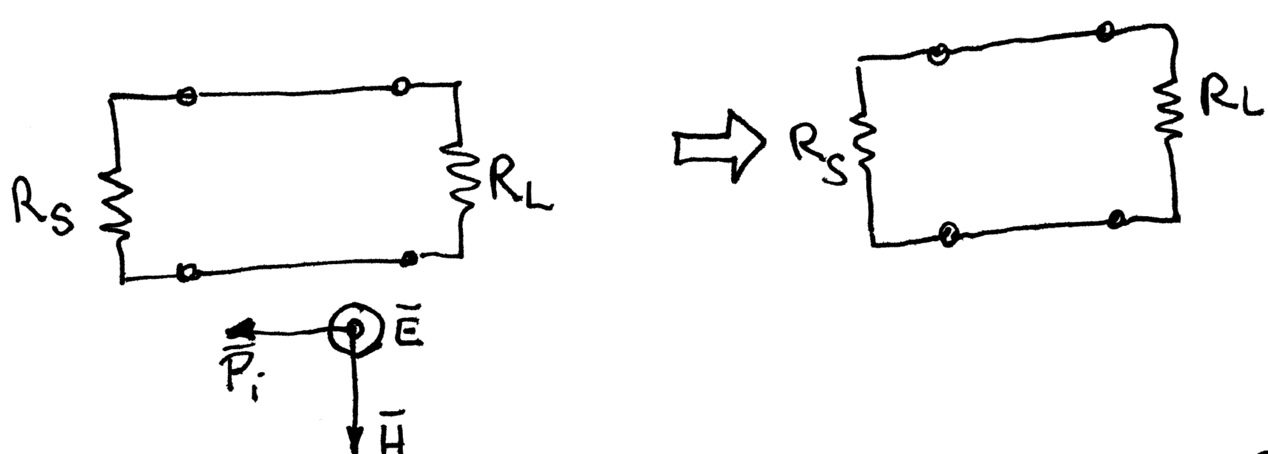


Si $H_n^i \neq 0$ ESTAN PRESENTES LAS DOS FUENTES
Si $E_t^i \neq 0$

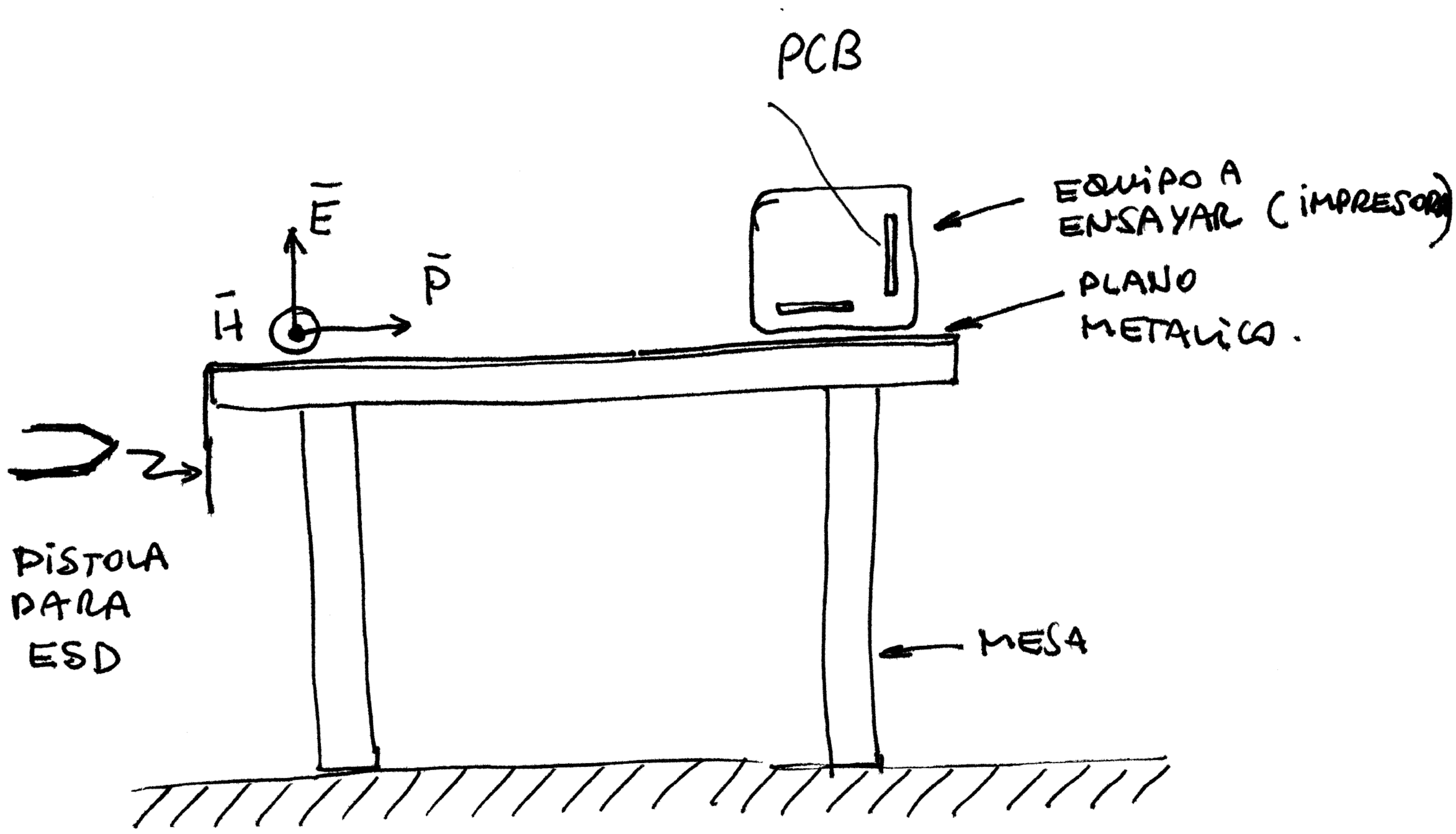
EFECTO DE DISTINTAS ONDAS INC.

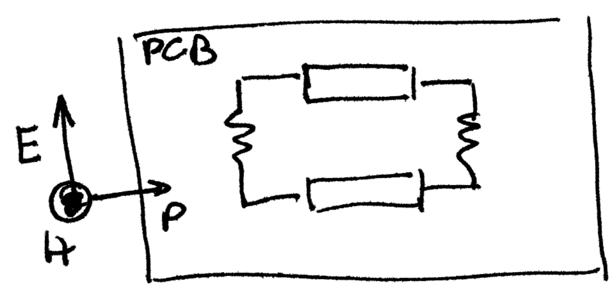






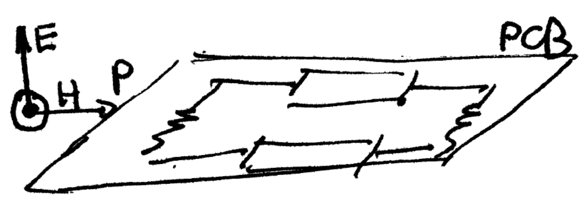
EJEMPLO: SE HACE EL TEST DE DESCARGA ELECTROESTATICA. CUAL POSICION DEL PCB ES MEJOR?





VERTICAL

E_t VA A GENERAR CORRIENTE



HORIZONTAL

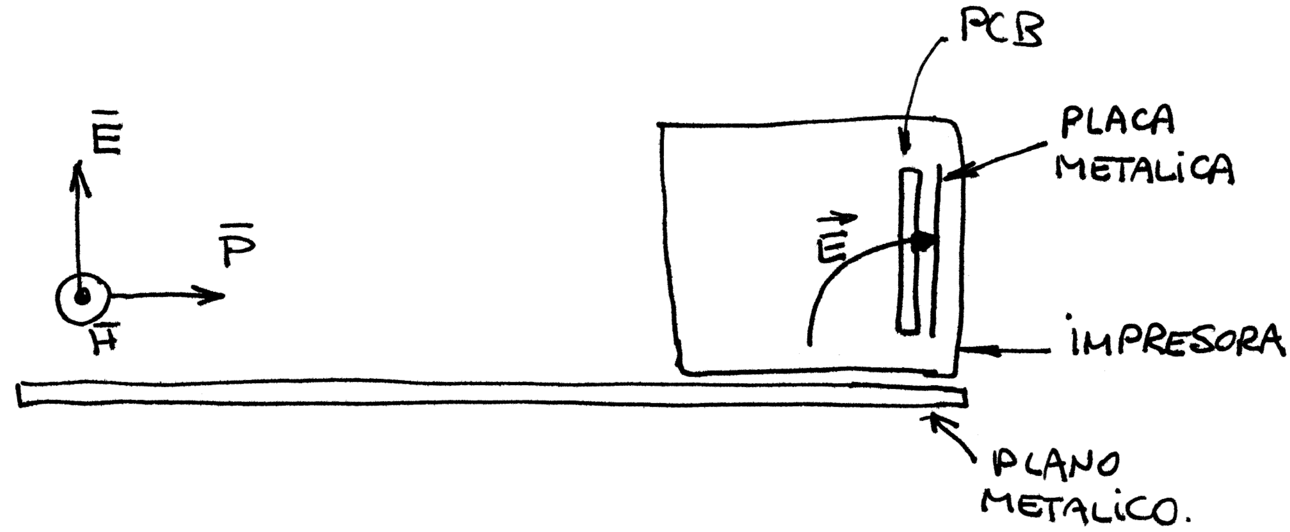
$H_n = 0$

Y

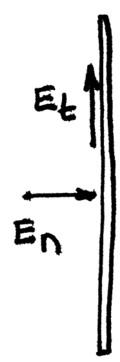
$E_t = 0$

NO HABRA FUENTES.

SI EN EL EJEMPLO ANTERIOR EL PCB QUEDO VERTICAL



SE COLOCA UNA PLACA METALICA.

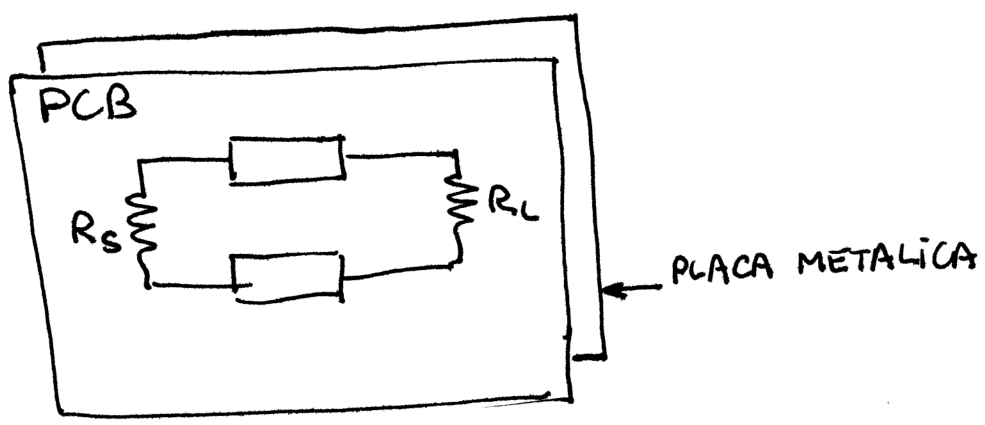


CONDUCTOR PERFECTO

$\sigma \to \infty$

$E_t = 0.$

$E_n \neq 0.$

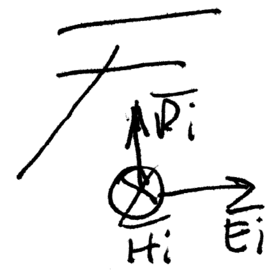


$E_t = 0.$

RESOLUCION: EJEMPLO 1

$$E^i = \frac{\sqrt{60 \cdot 50 \cdot 10^3 \cdot 10}}{1000} \frac{V}{m} = 5{,}47 \frac{V}{m}$$

$$H^i = \frac{E^i}{Z_{00}} = \frac{5{,}47 \; V/m}{377\Omega} = 14{,}52 \frac{mA}{m}$$



$$Z_C = \sqrt{\frac{L}{C}} = \frac{1}{\pi}\sqrt{\frac{\mu_0}{\epsilon_0 \epsilon_r}} \cdot \ln \frac{S}{r_w}$$

$$L = \frac{\mu_0}{\pi} \ln\left(\frac{S}{r_w}\right) \quad [H/m]$$

$$\epsilon_r = 1$$

$$C = \frac{\pi \epsilon_0 \epsilon_r}{\ln \frac{S}{r_w}} \quad [F/m]$$

$$Z_c = \frac{1}{\pi} \, 377\Omega \, \ln \frac{1{,}27}{0{,}19} = 227{,}98\Omega \cong 228\Omega$$

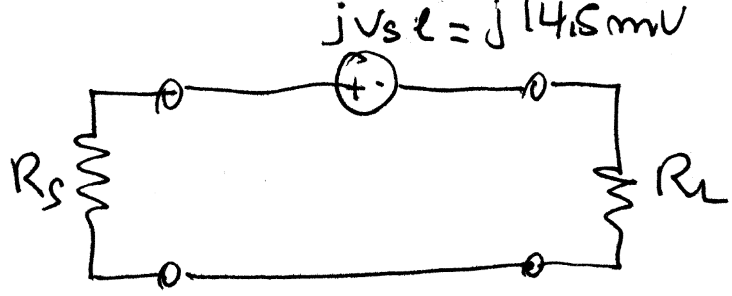
$$V_S = -\frac{R_S}{R_S + R_L} \, j\omega\mu_0 \, l \cdot S \, H_n^i - \cancel{\frac{R_S R_L}{R_S + R_L} \cdot j\omega C \, l \cdot S \cdot E_t^i}$$

$$V_L = +\frac{R_L}{R_S + R_L} \cdot j\omega\mu_0 \, l \cdot S \, H_n^i - \cancel{\frac{R_S R_L}{R_S + R_L} \, j\omega C \, l \cdot S \cdot E_t^i}$$

$$V_S = -\frac{50}{50+150} \cdot j2 \cdot \pi \cdot 100 \cdot 10^3 \cdot 1m \cdot 1{,}27 \cdot 10^{-3} \cdot 14{,}52 \frac{mA}{m} \, \mu_0$$

$$V_L = +\frac{150}{150+50} \cdot j \cdot 2\pi \cdot 100 \cdot 10^3 \cdot 1m \cdot 1{,}27 \cdot 10^{-3} \cdot 14{,}52 \frac{mA}{m} \cdot \mu_0$$

$$\boxed{\begin{array}{l} V_S = -j3{,}6 \text{ mV} \\ V_L = +j10{,}9 \text{ mV} \end{array}}$$

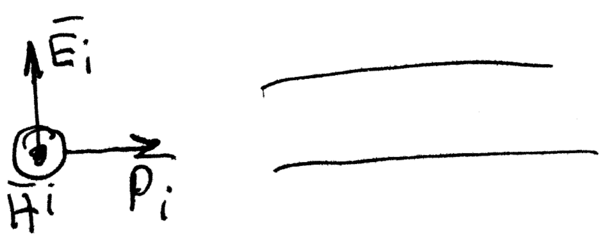


$V_s \ell \cong j\omega\mu_0 H_m^i . \text{Area}$

$V_s \ell = j 2\pi . 100 . 10^6 \, 4\pi 10^{-7} \, 14{,}52 . 10^{-3} . 1 . 1{,}27 . 10^{-3}$

$V_s \ell = j 14{,}5 . 10^{-3} \, V \equiv j \, 14{,}5 \, mV$

EJEMPLO 2



$V_s . \ell = j\omega\mu_0 H^i A = j \, 2\pi 100 . 10^6 . 4\pi 10^{-7} . 14{,}52 . 10^{-3} . 1 . 1{,}27 . 10^{-3}$

$V_s . \ell = j \, 14{,}5 \, mV$ (IGUAL QUE ANTES)

$I_s \ell = j\omega C E^i A = j \, 2\pi . 100 . 10^6 . 14{,}6 . 10^{-12} . 5{,}47 \frac{V}{m} . 1 . 1{,}27 . 10^{-3}$

$I_s \ell = j \, 6{,}37 . 10^{-5} A = j \, 0{,}06 \, mA$

$$C = \frac{\pi \epsilon_0 \epsilon_r}{\ln \frac{s}{r_w}} = \frac{\pi . 8{,}85 . 10^{-12} . 1}{\ln \frac{1{,}27}{0{,}19}} = 14{,}6 \frac{pF}{m}$$

$$V_s = \frac{-j150}{50+150} \, 14{,}5 mV - \frac{150 . 50}{150+50} \, j \, 0{,}06 mA . \Omega = \boxed{j5{,}87 mV}$$

$$V_L = \frac{+j150}{150+50} . 14{,}5 mV - \frac{150 . 50}{150+50} \, j \, 0{,}06 mA \Omega = \boxed{j8{,}62 mV}$$