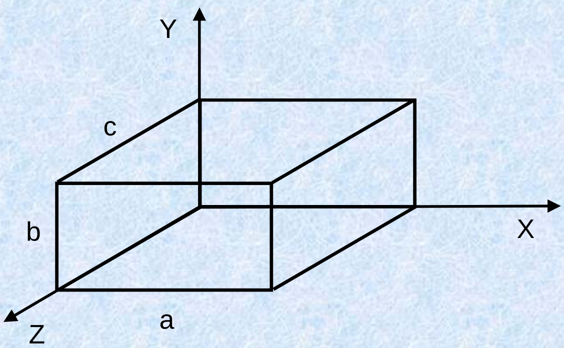
GUÍAS DE ONDAS

CAVIDAD RESONANTE

Cavidad resonante rectangular



En el interior de la cavidad se pueden generar diferentes ondas estacionarias: diferentes modos

Cavidad resonante rectangular

Modos TM

$$E_x = E_{0x}\cos\left(\frac{m\pi}{a}x\right)\operatorname{sen}\left(\frac{n\pi}{b}y\right)e^{j\beta z} - E_{0x}\cos\left(\frac{m\pi}{a}x\right)\operatorname{sen}\left(\frac{n\pi}{b}y\right)e^{-j\beta z}$$

$$E_x = 2jE_{0x}\cos\left(\frac{m\pi}{a}x\right)\operatorname{sen}\left(\frac{n\pi}{b}y\right)\operatorname{sen}(\beta z)$$

Condición de contorno:

$$E_x(z=0)=0$$

$$E_x(z=c)=0 \Rightarrow sen\,\beta c = 0 \Rightarrow \beta c = p\pi \qquad \beta = \frac{p\pi}{c}$$

p entero

Cavidad resonante rectangular

Modos TM

Frecuencia de resonancia:

$$\beta = \sqrt{k^2 - k_c^2} = \sqrt{k^2 - k_x^2 - k_y^2} \qquad \beta^2 = k^2 - k_x^2 - k_y^2$$

$$\beta^2 = k_x^2 + k_y^2 + \beta^2$$

$$k = 2\pi f\sqrt{\mu\varepsilon}$$

$$k_x = \frac{m\pi}{a} \qquad k_y = \frac{n\pi}{b} \qquad \beta = \frac{p\pi}{c}$$

m entero — n entero — p entero

$$f_{res} = \frac{1}{2\sqrt{\mu\varepsilon}}\sqrt{\left(\frac{m}{a}\right)^2 + \left(\frac{n}{b}\right)^2 + \left(\frac{p}{c}\right)^2}$$

m = 1, 2, 3,…
n = 1, 2, 3,…
p = 0, 1, 2,…

TM_{mnp}

Cavidad resonante rectangular

Modos TE

$$E_x = E_{0x}\cos\left(\frac{m\pi}{a}x\right)\text{sen}\left(\frac{n\pi}{b}y\right)e^{j\beta z} - E_{0x}\cos\left(\frac{m\pi}{a}x\right)\text{sen}\left(\frac{n\pi}{b}y\right)e^{-j\beta z}$$

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$$k^2 = k_x^2 + k_y^2 + \beta^2$$

$$k = 2\pi f\sqrt{\mu\varepsilon}$$

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m entero — n entero — p entero

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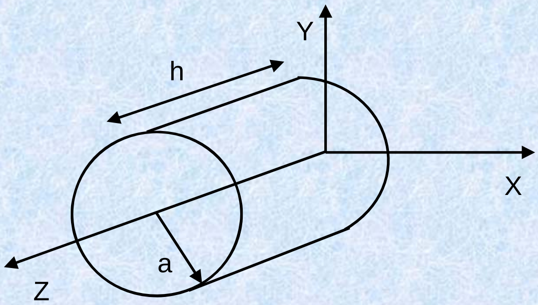
m = 0, 1, 2,…
n = 0, 1, 2,…
p = 1, 2, 3…

TE_{mnp}

Imposible a la vez: $m = 0; \quad n = 0$

Cavidad resonante cilíndrica



En el interior de la cavidad se pueden generar diferentes ondas estacionarias: diferentes modos

Cavidad resonante cilíndrica

Modos TM

$$E_\rho = E_{0\rho} J'_m(k_c\rho)(A\,\mathrm{sen}\, m\phi + B\cos m\phi)e^{j\beta z} - E_{0\rho} J'_m(k_c\rho)(A\,\mathrm{sen}\, m\phi + B\cos m\phi)e^{-j\beta z}$$

$$E_\rho = 2jE_{0\rho} J'_m(k_c\rho)(A\,\mathrm{sen}\, m\phi + B\cos m\phi)\,\mathrm{sen}\,\beta z$$

Condición de contorno:

$$\mathrm{E}_\rho(\mathrm{z}=0)=0$$

$$\mathrm{E}_\rho(\mathrm{z}=\mathrm{h})=0 \Longrightarrow sen\,\beta h = 0 \Longrightarrow \beta h = p\pi \qquad \beta = \frac{p\pi}{h}$$

p entero

4

Cavidad resonante cilíndrica

Modos TM

Frecuencia de resonancia:

$$\beta = \sqrt{k^2 - k_c^2}$$

$$\beta^2 = k^2 - k_c^2$$

$$k^2 = k_c^2 + \beta^2$$

$$k_c = \frac{\chi_{mn}}{a}$$

$$\beta = \frac{p\pi}{h}$$

p entero

$$k = 2\pi f \sqrt{\mu\varepsilon}$$

$$f_{res} = \frac{1}{2\pi\sqrt{\mu\varepsilon}} \sqrt{\left(\frac{\chi_{mn}}{a}\right)^2 + \left(\frac{p\pi}{h}\right)^2}$$

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n = 1, 2, 3,…
p = 0, 1, 2,…

TM_{mnp}

Cavidad resonante cilíndrica

Modos TE

$$E_\rho = E_{0\rho} J_m(k_c\rho)(A\cos m\phi - B\,\mathrm{sen}\, m\phi)e^{j\beta z} - E_{0\rho} J_m(k_c\rho)(A\cos m\phi - B\,\mathrm{sen}\, m\phi)e^{-j\beta z}$$

$$E_\rho = 2jE_{0\rho} J_m(k_c\rho)(A\cos m\phi - B\,\mathrm{sen}\, m\phi)\,\mathrm{sen}\,\beta z$$

Condición de contorno:

$$E_\rho(z=0) = 0$$

$$E_\rho(z=h) = 0 \Longrightarrow sen\,\beta h = 0 \Longrightarrow \beta h = p\pi$$

$$\beta = \frac{p\pi}{h}$$

p entero

Cavidad resonante cilíndrica

Modos TE

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$$\beta = \sqrt{k^2 - k_c^2}$$

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$$k_c = \frac{\chi'_{mn}}{a}$$

$$\beta = \frac{p\pi}{h}$$

p entero

$$k = 2\pi f \sqrt{\mu\varepsilon}$$

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TE_{mnp}