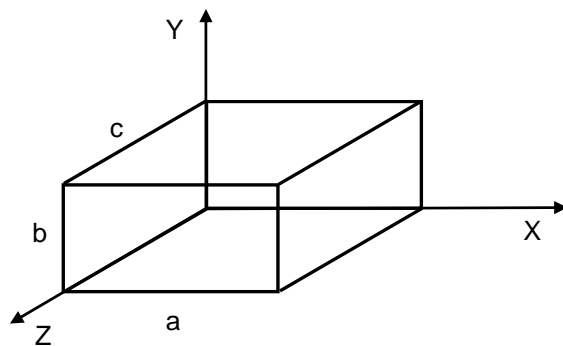


GUÍAS DE ONDAS

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:

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

$$E_x(z=c) = 0 \implies \operatorname{sen} \beta c = 0 \implies \beta c = p\pi \quad \beta = \frac{p\pi}{c}$$

p entero

Cavidad resonante rectangular

Modos TM

Frecuencia de resonancia:

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

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

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

$$k_x = \frac{m\pi}{a}$$

$$k_y = \frac{n\pi}{b}$$

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

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

m entero

n entero

p entero

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

m = 1, 2, 3, ...

n = 1, 2, 3, ...

p = 0, 1, 2, ...

TM_{mnp}

Cavidad resonante rectangular

Modos TE

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

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

Condición de contorno:

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

$$E_x(z=c) = 0 \implies \sin \beta c = 0 \implies \beta c = p\pi \quad \beta = \frac{p\pi}{c}$$

p entero

Cavidad resonante rectangular

Modos TE

Frecuencia de resonancia:

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

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

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

$$k_x = \frac{m\pi}{a}$$

$$k_y = \frac{n\pi}{b}$$

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

m entero

n entero

p entero

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

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

m = 0, 1, 2, ...

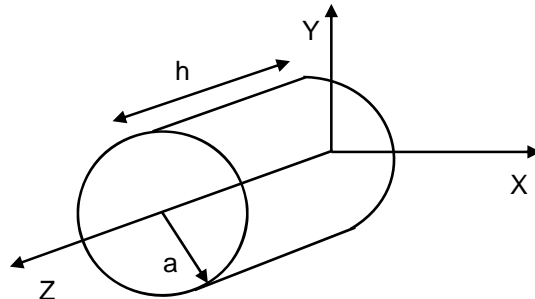
n = 0, 1, 2, ...

p = 1, 2, 3, ...

TE_{mnp}

Imposible a la vez: m = 0; n = 0

Cavidad resonante cilíndrica



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

Cavidad resonante cilíndrica

Modos TM

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

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

Condición de contorno:

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

$$E_{\rho}(z=h) = 0 \implies \sin \beta h = 0 \implies \beta h = p\pi$$

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

p entero

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

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

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

$$m = 0, 1, 2, \dots$$

$$n = 1, 2, 3, \dots$$

$$p = 0, 1, 2, \dots$$

TM_{mnp}

Cavidad resonante cilíndrica

Modos TE

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

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

Condición de contorno:

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

$$E_\rho(z=h) = 0 \implies \sin \beta h = 0 \implies \beta h = p\pi$$

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

p entero

Cavidad resonante cilíndrica

Modos TE

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

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

$$f_{\text{res}} = \frac{1}{2\pi\sqrt{\mu\epsilon}} \sqrt{\left(\frac{\chi'_{mn}}{a}\right)^2 + \left(\frac{p\pi}{h}\right)^2}$$

$$m = 0, 1, 2, \dots$$

$$n = 1, 2, 3, \dots$$

$$p = 1, 2, 3, \dots$$

TE_{mnp}