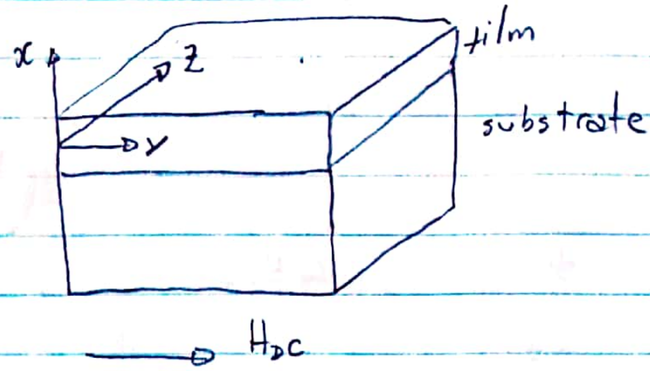
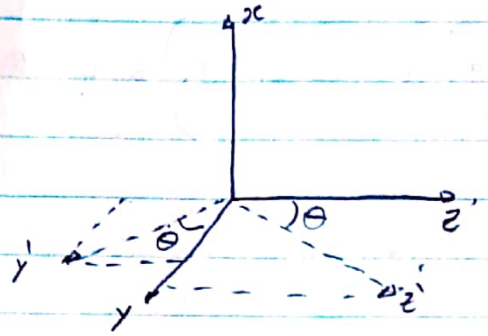
$$\nabla \times \bar{H} = \frac{d\bar{D}}{dt} \qquad \nabla \times \bar{E} = -\frac{d\bar{B}}{dt}$$

TMT
Anisotrópico
Girotrópico

$$\bar{B} = \mu \bar{H} \qquad \bar{D} = \bar{\bar{\epsilon}} \bar{E}$$





$$A = \begin{vmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & \sin\theta \\ 0 & -\sin\theta & \cos\theta \end{vmatrix} \qquad \epsilon = \begin{vmatrix} \epsilon_x & -j\delta & 0 \\ j\delta & \epsilon_y & 0 \\ 0 & 0 & \epsilon_z \end{vmatrix}$$

$$\epsilon' = A \epsilon A^T \qquad \theta = \pi/2$$

$$\epsilon' = \begin{vmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & -1 & 0 \end{vmatrix} \cdot \begin{vmatrix} \epsilon_x & -j\delta & 0 \\ j\delta & \epsilon_y & 0 \\ 0 & 0 & \epsilon_z \end{vmatrix} \cdot \begin{vmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{vmatrix}$$

$$\epsilon' = \begin{vmatrix} \epsilon_x & 0 & j\delta \\ 0 & \epsilon_z & 0 \\ -j\delta & 0 & \epsilon_y \end{vmatrix}$$

$$\nabla \times \bar{E} = -j\omega\mu_0 \bar{H} \qquad e^{j\omega t - \beta z}$$

$$\nabla \times \bar{H} = j\omega\epsilon_0 \bar{\bar{\epsilon}}\,\bar{E}$$

TM: H_y, E_x, E_z

$$\begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ E_x & 0 & E_z \end{vmatrix} = -j\omega\mu_0 H_y \hat{y}$$

$$\hat{x}\left(\frac{\partial E_z}{\partial y} - 0\right) - \hat{y}\left(\frac{\partial E_z}{\partial x} - \frac{\partial E_x}{\partial z}\right) + \hat{z}\left(0 - \frac{\partial E_x}{\partial y}\right) = -j\omega\mu_0 H_y \hat{y}$$

$$\boxed{\frac{\partial E_x}{\partial z} - \frac{\partial E_z}{\partial x} = -j\omega\mu_0 H_y} \qquad (1)$$

$$\begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ 0 & H_y & 0 \end{vmatrix} = j\omega\epsilon_0 \begin{vmatrix} \epsilon_x & 0 & j\delta \\ 0 & \epsilon_z & 0 \\ -j\delta & 0 & \epsilon_y \end{vmatrix} \begin{vmatrix} E_x \\ 0 \\ E_z \end{vmatrix}$$

$$\begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ 0 & H_y & 0 \end{vmatrix} = j\omega\epsilon_0 \begin{vmatrix} (\epsilon_x E_x + j\delta E_z)\hat{x} \\ 0 \\ (-j\delta E_x + \epsilon_y E_z)\hat{z} \end{vmatrix}$$

$$\hat{x}\left(0 - \frac{\partial H_y}{\partial z}\right) - \hat{y}(0 - 0) + \hat{z}\left(\frac{\partial H_y}{\partial x} - 0\right) = j\omega\epsilon_0 \begin{bmatrix} (\epsilon_x E_x + j\delta E_z)\hat{x} \\ (-j\delta E_x + \epsilon_y E_z)\hat{z} \end{bmatrix}$$

$$-\frac{\partial H_y}{\partial z} = j\omega\epsilon_0 (\epsilon_x E_x + j\delta E_z) \qquad (2)$$

$$\boxed{\frac{\partial H_y}{\partial x} = j\omega\epsilon_0 (-j\delta E_x + \epsilon_y E_z)} \qquad (3)$$

de ①

$$\boxed{-j\beta E_x - \frac{\partial E_z}{\partial x} = -j\omega\mu_0 H_y} \quad (4)$$

de ②: $$\boxed{j\beta H_y = j\omega\epsilon_0(\epsilon_x E_x + j\delta E_z)} \quad (5)$$

de ③: $$-\frac{j}{\omega\epsilon_0}\frac{dH_y}{dx} = -j\delta E_x + \epsilon_y E_z \quad (6)$$

de ⑤: $$\frac{\beta}{\omega\epsilon_0} H_y = \epsilon_x E_x + j\delta E_z \quad (7)$$

multiplicando ⑥ por $\epsilon_x / j\delta$

$$-\frac{\epsilon_x}{\omega\delta\epsilon_0}\frac{dH_y}{dx} = -\epsilon_x E_x + \frac{\epsilon_x\epsilon_y E_z}{j\delta} \quad (8)$$

⑦ + ⑧: $$\frac{\beta}{\omega\epsilon_0} H_y - \frac{\epsilon_x}{\delta\omega\epsilon_0}\frac{dH_y}{dx} = \left(j\delta + \frac{\epsilon_x\epsilon_y}{j\delta}\right) E_z$$

$$j\delta.\frac{\beta}{\omega\epsilon_0} H_y - j\cancel{\delta}\frac{\epsilon_x}{\cancel{\delta}\omega\epsilon_0}\frac{dH_y}{dx} = (-\delta^2 + \epsilon_x\epsilon_y) E_z$$

$$\frac{j\delta\beta}{\omega\epsilon_0} H_y - j\frac{\epsilon_x}{\omega\epsilon_0}\frac{dH_y}{dx} = (-\delta^2 + \epsilon_x\epsilon_y) E_z$$

$$E_z = \frac{1}{(-\delta^2 + \epsilon_x\epsilon_y)}\left[\frac{j\delta\beta}{\omega\epsilon_0} H_y - j\frac{\epsilon_x}{\omega\epsilon_0}\frac{dH_y}{dx}\right]$$

$$\boxed{E_z = \frac{1}{\omega\epsilon_0(-\delta^2 + \epsilon_x\epsilon_y)}\left[j\delta\beta H_y - j\epsilon_x\frac{dH_y}{dx}\right]} \quad (9)$$

de 7:

$$E_x = \frac{1}{\epsilon_x}\left[\frac{\beta}{\omega\epsilon_0} H_y - j\delta E_z\right]$$

$$E_x = \frac{1}{\epsilon_x}\left\{\frac{\beta}{\omega\epsilon_0} H_y - \frac{j\delta}{\omega\epsilon_0(-\delta^2+\epsilon_x\epsilon_y)}\left[j\delta\beta H_y - j\epsilon_x\frac{dH_y}{dx}\right]\right\}$$

$$E_x = \frac{1}{\omega\epsilon_0\epsilon_x}\left\{\beta H_y + \frac{\delta^2\beta}{(-\delta^2+\epsilon_x\epsilon_y)} H_y - \frac{\delta\epsilon_x}{(-\delta^2+\epsilon_x\epsilon_y)}\frac{dH_y}{dx}\right\}$$

$$E_x = \frac{1}{\omega\epsilon_0\epsilon_x(-\delta^2+\epsilon_x\epsilon_y)}\left[(\cancel{-\delta^2\beta}+\beta\epsilon_x\epsilon_y+\cancel{\delta^2\beta})H_y - \delta\epsilon_x\frac{dH_y}{dx}\right]$$

$$E_x = \frac{1}{\omega\epsilon_0\cancel{\epsilon_x}(-\delta^2+\epsilon_x\epsilon_y)}\left[\beta\cancel{\epsilon_x}\epsilon_y H_y - \delta\cancel{\epsilon_x}\frac{dH_y}{dx}\right]$$

$$\boxed{E_x = \frac{1}{\omega\epsilon_0(-\delta^2+\epsilon_x\epsilon_y)}\left[\beta\epsilon_y H_y - \delta\frac{dH_y}{dx}\right]} \quad (10)$$

substituindo 9 e 10 em 4:

$$-j\beta\cdot\frac{1}{\omega\epsilon_0(-\delta^2+\epsilon_x\epsilon_y)}\left[\beta\epsilon_y H_y - \delta\frac{dH_y}{dx}\right] - \frac{1}{\omega\epsilon_0(-\delta^2+\epsilon_x\epsilon_y)}\left[j\delta\beta\frac{dH_y}{dx} - j\epsilon_x\frac{d^2H_y}{dx^2}\right] = -j\omega\mu_0 H_y$$

$$-j\beta^2\epsilon_y H_y + \cancel{j\delta\beta\frac{dH_y}{dx}} - \cancel{j\delta\beta\frac{dH_y}{dx}} + j\epsilon_x\frac{d^2H_y}{dx^2} = -\omega\epsilon_0(-\delta^2+\epsilon_x\epsilon_y)j\omega\mu_0 H_y$$

$$-j\beta^2\epsilon_y H_y + j\epsilon_x \frac{d^2 H_y}{dx^2} = -\omega\epsilon_0\left(-\delta^2 + \epsilon_x\epsilon_y\right) j\omega\mu_0 H_y$$

$$\cancel{j}\,\epsilon_x \frac{d^2 H_y}{dx^2} + \cancel{j}\,\omega^2\mu_0\epsilon_0\left(-\delta^2 + \epsilon_x\epsilon_y\right) H_y - \cancel{j}\,\beta^2\epsilon_y H_y = 0$$

dividindo por ϵ_x :

$$\boxed{\frac{d^2 H_y}{dx^2} + \left[k_0^2\left(-\frac{\delta^2}{\epsilon_x} + \epsilon_y\right) - \beta^2\frac{\epsilon_y}{\epsilon_x}\right] H_y = 0} \qquad (11)$$

ou

$$\boxed{\frac{d^2 H_y}{dx^2} - \left[\beta^2\frac{\epsilon_y}{\epsilon_x} - k_0^2\left(-\frac{\delta^2}{\epsilon_x} + \epsilon_y\right)\right] H_y = 0} \qquad (12)$$

$$\gamma_j = \sqrt{\beta^2\frac{\epsilon_y}{\epsilon_x} - k_0^2\left(-\frac{\delta^2}{\epsilon_x} + \epsilon_y\right)}$$

Impondo as condições de contorno :

$$H_y^j(x) = A_j \exp\left[\gamma_j(x - t_j)\right] + B_j \exp\left[-\gamma_j(x - t_j)\right] \qquad (13)$$

B.C. : $$H_j^y(t_{j-1}) = H_{j-1}^y(t_{j-1}) \qquad (14)$$

$$E_j^z(t_{j-1}) = E_{j-1}^z(t_{j-1}) \qquad (15)$$

$$A_j \exp\left[\gamma_j(t_{j-1} - t_j)\right] + B_j \exp\left[-\gamma_j(t_{j-1} - t_j)\right] =$$

$$A_{j-1} \exp\left[\gamma_{j-1}(t_{j-1} - t_{j-1})\right] + B_{j-1} \exp\left[-\gamma_{j-1}(t_{j-1} - t_{j-1})\right]$$

$$\theta_j = (t_j - t_{j-1})\gamma_j = w_j \cdot \gamma_j$$

$$\boxed{A_{j-1} + B_{j-1} = A_j \exp(-\theta_j) + B_j \exp(\theta_j)} \quad (16)$$

Expandindo (15) :

$$E_z = \frac{1}{\omega \epsilon_0 (-\delta^2 + \epsilon_x \epsilon_y)} \left[j\delta\beta H_y - j\epsilon_x \frac{\delta H_y}{\delta x} \right]$$

$$E_j^z = \frac{1}{\omega \epsilon_0 (-\delta_j^2 + \epsilon_j^x \cdot \epsilon_j^y)} \left[j\delta_j \beta H_j^y - j\epsilon_j^x \frac{\delta H_j^y}{\delta x} \right] \quad (17)$$

$$E_{j-1}^z = \frac{1}{\omega \epsilon_0 (-\delta_{j-1}^2 + \epsilon_{j-1}^x \cdot \epsilon_{j-1}^y)} \left[j\delta_{j-1} \beta H_{j-1}^y - j\epsilon_{j-1}^x \frac{\delta H_{j-1}^y}{\delta x} \right] \quad (18)$$

$$E_j^z(t_{j-1}) = E_{j-1}^z(t_{j-1})$$

$$\frac{1}{\omega \epsilon_0 (-\delta_j^2 + \epsilon_j^x \cdot \epsilon_j^y)} \Big\{ j\beta\delta_j \Big(A_j \exp[\gamma_j (t_{j-1} - t_j)] + B_j \exp[-\gamma_j (t_{j-1} - t_j)] \Big)$$

$$- j\epsilon_j^x \Big(\gamma_j A_j \exp[\gamma_j (t_{j-1} - t_j)] - \gamma_j B_j \exp[-\gamma_j (t_{j-1} - t_j)] \Big) \Big\} =$$

$$\frac{1}{\omega \epsilon_0 (-\delta_{j-1}^2 + \epsilon_{j-1}^x \, \epsilon_{j-1}^y)} \Big[j\beta\delta_{j-1} \Big(A_{j-1} \cancel{\exp[\gamma_{j-1}(t_{j-1} - t_{j-1})]}^{\to 1} + B_{j-1} \cancel{\exp[-\gamma_j (t_{j-1} - t_{j-1})]}^{\to 1} \Big)$$

$$- j\epsilon_{j-1}^x \Big(\gamma_{j-1} A_{j-1} \cancel{\exp[\gamma_{j-1}(t_{j-1} - t_{j-1})]}^{\to 1} - \gamma_{j-1} B_{j-1} \cancel{\exp[-\gamma_{j-1}(t_{j-1} - t_{j-1})]}^{\to 1} \Big) \Big]$$

substituindo θ_j :

$$\frac{1}{(-\delta_j^2 + \epsilon_j^x \cdot \epsilon_j^y)} \left[j\beta\delta_j \left(A_j \exp(-\theta_j) + B_j \exp(\theta_j) \right) - \right.$$

$$\left. j\epsilon_j^x \left(\gamma_j A_j \exp(-\theta_j) - \gamma_j B_j \exp(\theta_j) \right) \right] =$$

$$\therefore \frac{1}{(-\delta_{j-1}^2 + \epsilon_{j-1}^x \cdot \epsilon_{j-1}^y)} \left[j\beta\delta_{j-1} \left(A_{j-1} + B_{j-1} \right) - j\epsilon_{j-1}^x \left(\gamma_{j-1} A_{j-1} - \gamma_{j-1} B_{j-1} \right) \right]$$

$$\therefore \Delta_j = \frac{(-\delta_{j-1}^2 + \epsilon_{j-1}^x \cdot \epsilon_{j-1}^y)}{(-\delta_j^2 + \epsilon_j^x \cdot \epsilon_j^y)}$$

$$\Delta_j \left[j\beta\delta_j \left(A_j \exp(-\theta_j) + B_j \exp(\theta_j) \right) - j\epsilon_j^x \left(\gamma_j A_j \exp(-\theta_j) - \gamma_j B_j \exp(\theta_j) \right) \right]$$

$$= \left[j\beta\delta_{j-1} \left(A_{j-1} + B_{j-1} \right) - j\epsilon_{j-1}^x \left(\gamma_{j-1} A_{j-1} - \gamma_{j-1} B_{j-1} \right) \right] \quad (19)$$

$$\Delta_j \left\{ A_j \exp(-\theta_j) \left[j\beta\delta_j - j\gamma_j \epsilon_j^x \right] + B_j \exp(\theta_j) \left[j\beta\delta_j + j\gamma_j \epsilon_j^x \right] \right\} =$$

$$\left\{ A_{j-1} \left[j\beta\delta_{j-1} - j\gamma_{j-1} \epsilon_{j-1}^x \right] + B_{j-1} \left[j\beta\delta_{j-1} + j\gamma_{j-1} \epsilon_{j-1}^x \right] \right\}$$

os "j" podem ser cancelados:

$$\therefore \Delta_j \left\{ A_j \exp(-\theta_j) \left[\beta\delta_j - \gamma_j \epsilon_j^x \right] + B_j \exp(\theta_j) \left[\beta\delta_j + \gamma_j \epsilon_j^x \right] \right\} =$$

$$\left\{ A_{j-1} \left[\beta\delta_{j-1} - \gamma_{j-1} \epsilon_{j-1}^x \right] + B_{j-1} \left[\beta\delta_{j-1} + \gamma_{j-1} \epsilon_{j-1}^x \right] \right\} \quad (20)$$

definindo:

$$a_j = \beta\delta_j - \gamma_j \epsilon_j^x \qquad b_j = \beta\delta_j + \gamma_j \epsilon_j^x$$

$$a_{j-1} = \beta\delta_{j-1} - \gamma_{j-1} \epsilon_{j-1}^x \qquad b_{j-1} = \beta\delta_{j-1} + \gamma_{j-1} \epsilon_{j-1}^x$$

$$\Delta_j \left\{ A_j \exp(-\theta_j) \cdot a_j + B_j \exp(\theta_j) \cdot b_j \right\} = A_{j-1} a_{j-1} + B_{j-1} b_{j-1}$$

$$A_{j-1} = \frac{1}{a_{j-1}} \left[-B_{j-1} b_{j-1} + \Delta_j a_j A_j \exp(-\theta_j) + \Delta_j b_j B_j \exp(\theta_j) \right] \quad (21)$$

de (16) :

$$B_{j-1} = A_j \exp(-\theta_j) + B_j \exp(\theta_j) - A_{j-1} \quad (22)$$

(22) $\rightarrow$ (21) :

$$A_{j-1} = \frac{1}{a_{j-1}} \left[A_{j-1} b_{j-1} - A_j \exp(-\theta_j) b_{j-1} - B_j \exp(\theta_j) b_{j-1} + \Delta_j a_j A_j \exp(-\theta_j) + \Delta_j b_j B_j \exp(\theta_j) \right]$$

$$A_{j-1} \left(1 - \frac{b_{j-1}}{a_{j-1}} \right) = \left[A_j \exp(-\theta_j) \frac{\left[\Delta_j a_j - b_{j-1} \right]}{a_{j-1}} + B_j \exp(\theta_j) \frac{\left[\Delta_j b_j - b_{j-1} \right]}{a_{j-1}} \right]$$

$$A_{j-1} (a_{j-1} - b_{j-1}) = \left\{ A_j \exp(-\theta_j) \left[\Delta_j a_j - b_{j-1} \right] + B_j \exp(\theta_j) \left[\Delta_j b_j - b_{j-1} \right] \right\}$$

$$\boxed{A_{j-1} = A_j \exp(-\theta_j) \left[\frac{\Delta_j a_j - b_{j-1}}{a_{j-1} - b_{j-1}} \right] + B_j \exp(\theta_j) \left[\frac{\Delta_j b_j - b_{j-1}}{a_{j-1} - b_{j-1}} \right]} \quad (23)$$

(23) $\rightarrow$ (22) :

$$B_{j-1} = A_j \exp(-\theta_j) + B_j \exp(\theta_j) - A_j \exp(-\theta_j) \left[\frac{\Delta_j a_j - b_{j-1}}{a_{j-1} - b_{j-1}} \right] - B_j \exp(\theta_j) \left[\frac{\Delta_j b_j - b_{j-1}}{a_{j-1} - b_{j-1}} \right]$$

$$B_{j-1} = A_j \exp(-\theta_j)\left[1 - \frac{\Delta_j a_j - b_{j-1}}{a_{j-1} - b_{j-1}}\right] + B_j \exp(\theta_j)\left[1 - \frac{\Delta_j b_j - b_{j-1}}{a_{j-1} - b_{j-1}}\right]$$

$$B_{j-1} = A_j \exp(-\theta_j)\left[\frac{a_{j-1} - \cancel{b_{j-1}} - \Delta_j a_j + \cancel{b_{j-1}}}{a_{j-1} - b_{j-1}}\right] + B_j \exp(\theta_j)\left[\frac{a_{j-1} - \cancel{b_{j-1}} - \Delta_j b_j + \cancel{b_{j-1}}}{a_{j-1} - b_{j-1}}\right]$$

$$\boxed{B_{j-1} = A_j \exp(-\theta_j)\left[\frac{a_{j-1} - \Delta_j a_j}{a_{j-1} - b_{j-1}}\right] + B_j \exp(\theta_j)\left[\frac{a_{j-1} - \Delta_j b_j}{a_{j-1} - b_{j-1}}\right]} \quad (24)$$

Normalização:

$$P = \int S_z\, dx = \frac{1}{2}\int_{-\infty}^{\infty} \bar{E} \times \bar{H}^* dx = 1 \frac{W}{m} \quad (25)$$

de (10): $$E_x = \frac{1}{\omega \epsilon_0(-\delta^2 + \epsilon_x \epsilon_y)}\left[\beta \epsilon_y H_y - \delta \frac{\partial H_y}{dx}\right]$$

$$\frac{1}{2\omega \epsilon_0}\left[\int_{-\infty}^{\infty} \frac{\beta \epsilon_y}{(-\delta^2 + \epsilon_x \epsilon_y)} . |H_y|^2 dx - \int_{-\infty}^{\infty} \frac{\delta}{(-\delta^2 + \epsilon_x \epsilon_y)} \frac{\delta H_y}{\delta x} . H_y^* dx\right] = 1 \quad (26)$$

$$H_y \cdot H_y^* = |H_y|^2 = \left\{A_j \exp\left[\gamma_j (x - t_j)\right] + B_j \exp\left[-\gamma_j (x - t_j)\right]\right\} \cdot$$
$$\left\{A_j^* \exp\left[\gamma_j^* (x - t_j)\right] + B_j^* \exp\left[-\gamma_j^* (x - t_j)\right]\right\}$$

$$|H_y|^2 = |A_j|^2 \exp\left[(\gamma_j + \gamma_j^*)(x - t_j)\right] + A_j B_j^* \exp\left[(\gamma_j - \gamma_j^*)(x - t_j)\right] +$$
$$A_j^* B_j \exp\left[-(\gamma_j - \gamma_j^*)(x - t_j)\right] + |B_j|^2 \exp\left[-(\gamma_j + \gamma_j^*)(x - t_j)\right] \quad (27)$$

Abrindo a primeira integral:

$$\int_{-\infty}^{\infty} \frac{\beta \epsilon_y}{(-\delta^2+\epsilon_x\epsilon_y)} |H_y|^2 dx =$$

$$\frac{\beta \epsilon_y}{(-\delta^2+\epsilon_x\epsilon_y)} \left[\frac{|A_j|^2}{(\gamma_j+\gamma_j^*)} \cdot \exp\left[(\gamma_j+\gamma_j^*)(x-t_j)\right] + \right.$$

$$\frac{A_j B_j^*}{(\gamma_j-\gamma_j^*)} \cdot \exp\left[(\gamma_j-\gamma_j^*)(x-t_j)\right] -$$

$$\frac{A_j^* B_j}{\gamma_j-\gamma_j^*} \cdot \exp\left[-(\gamma_j-\gamma_j^*)(x-t_j)\right] -$$

$$\left. \frac{|B_j|^2}{(\gamma_j+\gamma_j^*)} \cdot \exp\left[-(\gamma_j+\gamma_j^*)(x-t_j)\right] \right] \quad (28)$$

Abrindo a segunda integral:

$$-\int_{-\infty}^{\infty} \frac{\delta}{(-\delta^2+\epsilon_x\epsilon_y)} \cdot \frac{dH_y}{dx} \cdot H_y^* \, dx = ?$$

$$H_y^* = A_j^* \exp\left[\gamma_j^*(x-t_j)\right] + B_j^* \exp\left[-\gamma_j^*(x-t_j)\right] \quad (29)$$

$$\frac{dH_y}{dx} = \gamma_j A_j \exp\left[\gamma_j(x-t_j)\right] - \gamma_j B_j \exp\left[-\gamma_j(x-t_j)\right] \quad (30)$$

→ (29)·(30):

$$\frac{dH_y}{dx} \cdot H_y^* = \gamma_j |A_j|^2 \exp\left[(\gamma_j^*+\gamma_j)(x-t_j)\right] -$$

$$\gamma_j A_j^* B_j \exp\left[(\gamma_j^*-\gamma_j)(x-t_j)\right] +$$

$$\gamma_j B_j^* A_j \exp\left[(-\gamma_j^*+\gamma_j)(x-t_j)\right] -$$

$$\gamma_j |B_j|^2 \exp\left[-(\gamma_j^*+\gamma_j)(x-t_j)\right]$$

Logo:

$$-\int_{-\infty}^{\infty} \frac{\delta}{(-\delta^2+\epsilon_x\epsilon_y)} \cdot \frac{dH_y}{dx} \cdot H_y^* \, dx =$$

$$- \frac{\delta}{(-\delta^2+\epsilon_x\epsilon_y)} \cdot \left[\frac{\gamma_j |A_j|^2}{(\gamma_j^*+\gamma_j)} \exp[(\gamma_j^*+\gamma_j)(x-t_j)] - \right.$$

$$\frac{\gamma_j A_j^* B_j}{(\gamma_j^*-\gamma_j)} \exp[(\gamma_j^*-\gamma_j)(x-t_j)] +$$

$$\frac{\gamma_j B_j^* A_j}{(-\gamma_j^*+\gamma_j)} \exp[(-\gamma_j^*+\gamma_j)(x-t_j)] +$$

$$\left. \frac{\gamma_j |B_j|^2}{(\gamma_j^*+\gamma_j)} \exp[-(\gamma_j^*+\gamma_j)(x-t_j)] \right] \quad (31)$$

Assim, substituindo (28) e (31) em (26):

$$\frac{1}{2\omega\epsilon_0} \left\{ \frac{\beta\epsilon_y}{(-\delta^2+\epsilon_x\epsilon_y)} \left[\frac{|A_j|^2}{(\gamma_j+\gamma_j^*)} \cdot \exp[(\gamma_j+\gamma_j^*)(x-t_j)] + \right. \right.$$

$$\frac{A_j B_j^*}{(\gamma_j-\gamma_j^*)} \cdot \exp[(\gamma_j-\gamma_j^*)(x-t_j)] - \frac{A_j^* B_j}{\gamma_j-\gamma_j^*} \cdot \exp[-(\gamma_j-\gamma_j^*)(x-t_j)] -$$

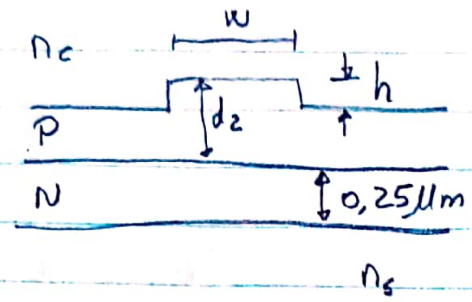
$$\left. \frac{|B_j|^2}{(\gamma_j+\gamma_j^*)} \cdot \exp[-(\gamma_j+\gamma_j^*)(x-t_j)] \right] -$$

$$\frac{\delta}{(-\delta^2+\epsilon_x\epsilon_y)} \left[\frac{\gamma_j |A_j|^2}{(\gamma_j^*+\gamma_j)} \cdot \exp[(\gamma_j^*+\gamma_j)(x-t_j)] - \right.$$

$$\frac{\gamma_j A_j^* B_j}{(\gamma_j^*-\gamma_j)} \cdot \exp[(\gamma_j^*-\gamma_j)(x-t_j)] + \frac{\gamma_j B_j^* A_j}{(-\gamma_j^*+\gamma_j)} \exp[(-\gamma_j^*+\gamma_j)(x-t_j)] +$$

$$\left. \left. \frac{\gamma_j |B_j|^2}{(\gamma_j^*+\gamma_j)} \cdot \exp[-(\gamma_j^*+\gamma_j)(x-t_j)] \right] \right\} \Bigg|_a^b = 1 \quad (32)$$

$\rightarrow$ limites de integração.



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$\lambda = 1.3\,\mu m$

$N \Rightarrow \quad n = 2.33$

$\theta_F^N = -1450°/cm$

$w = 2\,\mu m$

$h = 0{,}04\,\mu m$

$P \Rightarrow \quad n = 2.27$

$\theta_F^P = 350°/cm$

$n_s = 1{,}95$

$n_c = 1{,}00$

$\delta^N = -0{,}0024$

$\delta^P = +5{,}8897 \times 10^{-4}$

$d_2 = 0{,}65\,\mu m - 0{,}25\,\mu m$ Caso B

$d_2 = 0{,}50\,\mu m - 0{,}20\,\mu m$ Caso C

$\Delta\beta = 9{,}30828$ rd/cm Caso B

$\Delta\beta = -12{,}3378$ rd/cm Caso C