Foaie de formule

Unda plană

$$\nabla\cdot\vec{D}=\rho_{E,v} \tag{1}$$

$$\nabla\cdot\vec{B}=0 \tag{2}$$

$$\nabla\times\vec{E}=\frac{-\partial\vec{B}}{\partial t} \tag{3}$$

$$\nabla\times\vec{H}=\frac{+\partial\vec{D}}{\partial t}+\vec{J}_E \tag{4}$$

$$\vec{D}=\varepsilon_r\,\varepsilon_0\cdot\vec{E}\,,unde\;\varepsilon_0\simeq 8{,}854\cdot10^{-12}\,F\cdot m^{-1} \tag{5}$$

$$\vec{B}=\mu_r\mu_0\cdot\vec{H}\,,unde\;\mu_0\simeq 4\,\pi\cdot10^{-7}\,H\cdot m^{-1} \tag{6}$$

$$\nabla\times\vec{H}=+j\,\omega\,\varepsilon\,\vec{E}+\sigma\cdot\vec{E} \tag{7}$$

$$\nabla^2\vec{E}+\omega^2\mu\,\varepsilon\,\vec{E}=0 \tag{8}$$

$$E_x(z,t)=E_0^+\,e^{j(\omega t-kz)}+E_0^-\,e^{j(\omega t+kz)} \tag{9}$$

$$v_\varphi=\frac{dz}{dt}=\frac{\omega}{k}=\frac{1}{\sqrt{\mu\,\varepsilon}} \tag{10}$$

$$\lambda=\frac{2\pi}{k}=\frac{2\pi\cdot c}{\omega}=\frac{c}{f} \tag{11}$$

$$H_y(z,t)=\frac{1}{Z_U}[E_0^+e^{j(\omega t-kz)}-E_0^-\,e^{j(\omega t+kz)}] \tag{12}$$

$$Z_U=\frac{E_o^+}{H_0^+} \tag{13}$$

$$Z_{TEM}=Z_d=\frac{\omega\,\mu}{k}=\sqrt{\frac{\mu}{\epsilon}} \tag{14}$$

$$Z_{d0}=\sqrt{\frac{\mu_0}{\epsilon_0}}\simeq 377\,\Omega \tag{15}$$

Linii de transmisie

$$\frac{d^2U(x)}{d\,x^2}-(R_0+j\omega\,L_0)(G_0+j\,\omega\,C_0)U(x)=0 \tag{16}$$

$$\frac{d^2I(x)}{d\,x^2}-(R_0+j\,\omega\,L_0)(G_0+j\omega\,C_0)I(x)=0 \tag{17}$$

$$\gamma=\alpha+j\beta=\sqrt{(R_0+j\omega\,L_0)(G_0+j\,\omega\,C_0)} \tag{18}$$

$$U(x)=U_0^+e^{-\gamma x}+U_0^-e^{+\gamma x} \tag{19}$$

$$I(x)=I_0^+e^{-\gamma x}+I_0^-e^{+\gamma x} \tag{20}$$

$$I(x)=\frac{\gamma}{(R_0+j\omega\,L_0)}(U_0^+e^{-\gamma x}-U_0^-e^{+\gamma x}) \tag{21}$$

$$Z_C=\frac{U_0^+}{I_0^+}=\frac{-U_0^-}{I_0^-} \tag{22}$$

$$Z_C=\sqrt{\frac{R_0+j\,\omega\,L_0}{G_0+j\,\omega\,C_0}} \tag{23}$$

$$Z_C=\frac{j\omega\,L_0}{\gamma}=\sqrt{\frac{L_0}{C_0}} \tag{24}$$

$$\beta=\omega\cdot\sqrt{L_0\cdot C_0} \tag{25}$$

$$v_\varphi=\frac{\omega}{\beta}=\frac{1}{\sqrt{L_0C_0}} \tag{26}$$

$$\Gamma_0=\frac{U_0^-}{U_0^+}=\frac{Z_S-Z_C}{Z_S+Z_C} \tag{27}$$

$$\Gamma_x=\frac{U^-(x)}{U^+(x)}=\frac{U^-(0)e^{j(\beta x)}}{U^+(0)e^{j(-\beta x)}}=\Gamma_0\cdot e^{j\cdot2\beta x} \tag{28}$$

$$\sigma(sau\,VSWR)=\frac{1+|\Gamma_0|}{1-|\Gamma_0|} \tag{29}$$

$$Z_i(L)=Z_C\cdot\frac{Z_S+j\,Z_C\cdot\tan(\beta L)}{Z_C+j\,Z_S\cdot\tan(\beta L)} \tag{30}$$

$$Z_i(\lambda/4)=\frac{Z_C^2}{Z_S} \tag{31}$$

$$C_0=\frac{2\cdot\pi\,\varepsilon_0\varepsilon_r}{\ln(\frac{D}{d})} \tag{32}$$

$$L_0=\frac{\mu_0\mu_r}{2\cdot\pi}\ln(\frac{D}{d}) \tag{33}$$

Ghiduri de undă

$$Z_{TE}=\frac{Z_d}{\sqrt{1-\left(\frac{f_c}{f}\right)^2}} \tag{34}$$

$$Z_{TM}=Z_d\cdot\sqrt{1-\left(\frac{f_c}{f}\right)^2} \tag{35}$$

$$v_\phi=\frac{\omega}{\beta_g}=\frac{c}{\sqrt{1-\left(\frac{f_c}{f}\right)^2}} \tag{36}$$

$$v_g=\frac{d\omega}{d\beta_g}=c\cdot\sqrt{1-\left(\frac{f_c}{f}\right)^2} \tag{37}$$

$$\lambda_g=\frac{\lambda}{\sqrt{1-(\frac{f_c^2}{f^2})}} \tag{38}$$

$$f_{c,(m,n)}=\frac{c}{2}\sqrt{\left(\frac{m}{a}\right)^2+\left(\frac{n}{b}\right)^2} \tag{39}$$