2 TEM VALOVANJE V KOAKSIALNEM KABLU

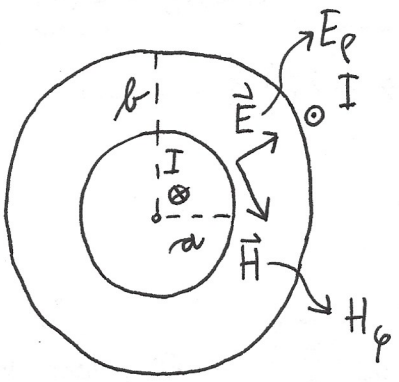
$$\varepsilon(\omega) = 1 - \frac{\omega_p^2}{\omega^2}$$

a) $\omega = v k = \frac{c_0}{\sqrt{\varepsilon}} k \rightarrow \omega^2 \left(1 - \frac{\omega_p^2}{\omega^2}\right) = c_0^2 k^2$

$$\omega^2 - \omega_p^2 = c_0^2 k^2 \rightarrow \underline{\omega = \sqrt{\omega_p^2 + c_0^2 k^2}}$$

b) impedanca vodnika

$$\vec{\nabla} \times \vec{E} = -\mu_0 \frac{\partial \vec{H}}{\partial t} = i\omega\mu_0 \vec{H} = i\vec{k} \times \vec{E} \rightarrow \vec{H} = \frac{\vec{k}}{\omega\mu_0} \times \vec{E}$$



$$H_\varphi = \frac{k}{\omega\mu_0} E_\rho$$

$$\frac{k}{\omega\mu_0} = \frac{1}{c\mu_0} = \frac{\sqrt{\varepsilon}\sqrt{\varepsilon_0\mu_0}}{\mu_0} = \sqrt{\varepsilon}\sqrt{\frac{\varepsilon_0}{\mu_0}} = \frac{\sqrt{\varepsilon}}{Z_0}$$

$$\underline{H_\varphi = \frac{\sqrt{\varepsilon}}{Z_0} E_\rho} \rightarrow \text{zvezo med } H_\varphi \text{ in } E_\rho \text{ potrebujemo!}$$

$\underline{Z = \frac{U}{I}}$ standardna definicija

$$\mu_0 I = 2\pi r H_\varphi \mu_0 \Rightarrow \underline{I = 2\pi r H_\varphi}$$

$$e = 2\pi\varepsilon_0 r l E_\rho \Rightarrow E_\rho = \frac{e}{2\pi\varepsilon_0 l r}$$

$$U = \int_a^b E_\rho \, dr = \frac{e}{2\pi\varepsilon_0 l} \ln\frac{b}{a} = \underline{E_\rho r \ln\frac{b}{a}}$$

$$Z = \frac{E_\rho r \ln\frac{b}{a}}{2\pi r H_\varphi} = \frac{\ln\frac{b}{a}}{2\pi}\left(\frac{\sqrt{\varepsilon}}{Z_0}\right)^{-1} = \boxed{\frac{\ln\frac{b}{a}}{2\pi} \frac{Z_0}{\sqrt{1 - \frac{\omega_p^2}{\omega^2}}}}$$