

2 TEM VALOVANJE V KOAKSIALNEM KABLU

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

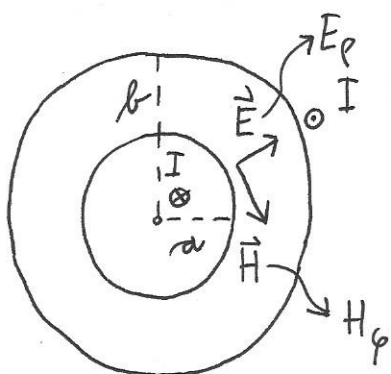
$$a) \quad \omega = ck = \frac{c_0}{\sqrt{\epsilon}} k \rightarrow \omega^2 \left(1 - \frac{\omega_p^2}{\omega^2}\right) = c_0^2 k^2$$

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

b) impedanca vodnika

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

$$H_\varphi = \frac{k}{\omega\mu_0} E_r$$



$$\frac{k}{\omega\mu_0} = \frac{1}{ck\mu_0} = \frac{\sqrt{\epsilon} \sqrt{\epsilon_0\mu_0}}{\mu_0} = \sqrt{\epsilon} \sqrt{\frac{\epsilon_0}{\mu_0}} = \frac{\sqrt{\epsilon}}{Z_0}$$

$$H_\varphi = \frac{\sqrt{\epsilon}}{Z_0} E_r$$

→ povez med  $H_\varphi$  &  $E_r$  potrebujemo!

$$Z = \frac{U}{I} \quad \text{standardna definicija}$$

$$\mu_0 I = 2\pi r H_\varphi \mu_0 \Rightarrow I = 2\pi r H_\varphi$$

$$e = 2\pi \epsilon_0 l E_r \Rightarrow E_r = \frac{e}{2\pi \epsilon_0 l r}$$

$$U = \int_a^b E_r dr = \frac{e}{2\pi \epsilon_0 l} \ln \frac{b}{a} = E_r r \ln \frac{b}{a}$$

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