12. auditorna vježba

- Jednadžba vala elek. polja

$$\nabla^2 \vec{E} - \mu_0 \cdot \varepsilon_0 \cdot \frac{\partial^2 \vec{E}}{\partial t^2} = 0$$

$$\vec{E}(\vec{r}, t) = \vec{E}_0 \cdot \cos(\vec{k} \cdot \vec{r} - \omega t + \phi)$$

$$\vec{E}_0 \cdot \vec{k} = 0$$

- Jednadžba vala mag. polja

$$\nabla^2 \vec{B} - \mu_0 \cdot \varepsilon_0 \cdot \frac{\partial^2 \vec{B}}{\partial t^2} = 0$$

$$\vec{B}(\vec{r}, t) = \vec{B}_0 \cdot \cos(\vec{k} \cdot \vec{r} - \omega t + \phi)$$

$$\vec{B}_0 \cdot \vec{k} = 0$$

- Poveznica elek. i mag. vala

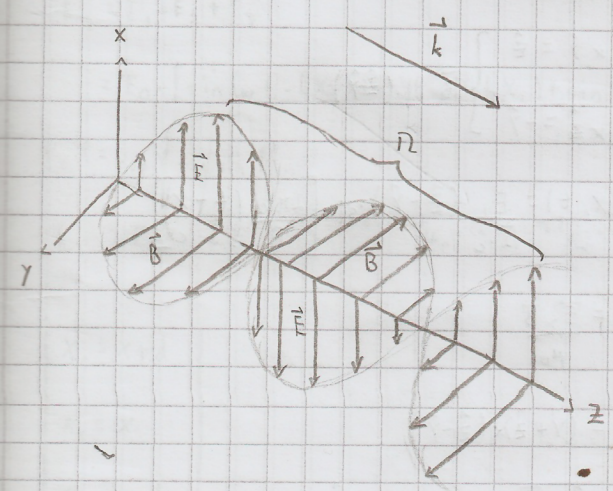
$$\vec{B} = \frac{\vec{k}}{|\vec{k}|} \times \frac{\vec{E}}{c}$$

$$\lambda = \frac{2\pi}{k}$$

- Poyntingov vektor

$$\vec{S} = \frac{\vec{E} \times \vec{B}}{\mu_0}$$

$$I = \langle \vec{S} \cdot \hat{k} \rangle$$



z1) $B_x = B_z = 0$

$$B_y = -10^{-3}\ T \cdot \sin\left[2 \cdot 10^{14}\ \pi\ s^{-1} \cdot \left(t - \frac{x}{c}\right)\right]$$

$E = ?$

$$E = E_z = E_0 \cdot \sin\left[2 \cdot 10^{14}\ \pi\ s^{-1} \cdot \left(t - \frac{x}{c}\right)\right]$$

$$\vec{B} = \hat{k} \times \frac{\vec{E}}{c} \rightarrow \vec{E} = \vec{B} \times \vec{k}$$

$$\vec{E} = -\hat{y} \times \hat{x} = z$$

$$E_0 = B_0 \cdot c$$

$$= 10^{-9} \cdot c = 0.3\ V/m$$

$$E_z = 0.3\ V/m \cdot \sin\left[2 \cdot 10^{14}\ \pi\ s^{-1} \cdot \left(t - \frac{x}{c}\right)\right]$$

z2) $E_x = 0$ $\quad B_x = 0$

$E_y = E_0 \cdot e^{i(\omega t - kx)}$ $\quad B_y = 0$

$E_z = 0$ $\quad B_z = B_0 \cdot e^{i(\omega t - kx)}$

$k = ?$

$$\frac{\partial^2 \vec{E}}{\partial x^2} = \frac{1}{c^2} \frac{\partial^2 \vec{E}}{\partial t^2} \qquad \frac{\partial^2 \vec{B}}{\partial x^2} = \frac{1}{c^2} \cdot \frac{\partial^2 \vec{B}}{\partial t^2}$$

$$\frac{\partial^2 \vec{E}_y}{\partial x^2} = E_0 \cdot e^{i(\omega t - kx)} \cdot (-i \cdot k)^2$$

$$= -E_0 \cdot k^2 \cdot e^{i(\omega t - kx)}$$

$$\frac{\partial^2 \vec{B}_z}{\partial x^2} = -B_0 \cdot k^2 \cdot e^{i(\omega t - kx)}$$

$$\frac{\partial^2 \vec{E}_y}{\partial t^2} = -E_0 \cdot \omega^2 \cdot e^{i(\omega t - kx)}$$

$$\frac{\partial^2 \vec{B}_z}{\partial t^2} = -B_0 \cdot \omega^2 \cdot e^{i(\omega t - kx)}$$

$$-E_0 \cdot k^2 \cdot e^{i(\omega t - kx)} = -\frac{E_0 \cdot \omega^2 \cdot e^{i(\omega t - kx)}}{c^2}$$

$$k^2 = \frac{\omega^2}{c^2} \rightarrow k = \frac{\omega}{c}$$

$$-B_0 \cdot k^2 \cdot e^{i(\omega t - kx)} = -\frac{B_0 \cdot \omega^2 \cdot e^{i(\omega t - kx)}}{c^2}$$

$$k^2 = \frac{\omega^2}{c^2} \rightarrow k = \frac{\omega}{c}$$

z3) $f = 5 \cdot 10^{14}\ Hz$

$I = 1\ W/m^2$

$\vec{k} \parallel \hat{z}$

$\vec{E} \parallel \hat{x}$