Mükemmel İletken Ortama Dik Etkiyen Dalga

Mükemmel iletken için $\sigma \to \infty$

$\eta_2 = 0$

$\Gamma = -1;\ \tau = 0$

Bir başka deyişle, etkiyen dalga ters dönerek (fazı 180 derece değişerek) aynen geri yansır.

Bu durumda:

$$\overline{E}_1(z) = \overline{E}_i(z) + \overline{E}_r(z) = \hat{a}_x E_{i0} e^{-j\beta_1 z} + \hat{a}_x E_{r0} e^{+j\beta_1 z}$$

$$= \hat{a}_x E_{i0} e^{-j\beta_1 z} + \hat{a}_x \Gamma E_{i0} e^{+j\beta_1 z}$$

$$= \hat{a}_x E_{i0} e^{-j\beta_1 z} - \hat{a}_x E_{i0} e^{+j\beta_1 z}$$

$$= \hat{a}_x E_{i0} (e^{-j\beta_1 z} - e^{+j\beta_1 z})$$

$$= \hat{a}_x E_{i0}\, 2j \frac{(e^{-j\beta_1 z} - e^{+j\beta_1 z})}{2j}$$

$$= -\hat{a}_x E_{i0}\, 2j \frac{(e^{+j\beta_1 z} - e^{-j\beta_1 z})}{2j}$$

$$= -2j\hat{a}_x E_{i0} \sin(\beta_1 z)$$

$$\overline{H}_1(z) = \overline{H}_i(z) + \overline{H}_r(z) = \hat{a}_y \frac{E_{i0}}{\eta_1} e^{-j\beta_1 z} - \hat{a}_y \Gamma \frac{E_{i0}}{\eta_1} e^{+j\beta_1 z}$$

$$= \hat{a}_y \frac{E_{i0}}{\eta_1} e^{-j\beta_1 z} + \hat{a}_y \frac{E_{i0}}{\eta_1} e^{+j\beta_1 z}$$

$$= \hat{a}_y \frac{E_{i0}}{\eta_1} (e^{-j\beta_1 z} + e^{+j\beta_1 z})$$

$$= \hat{a}_y \frac{E_{i0}}{\eta_1} 2 \frac{(e^{-j\beta_1 z} + e^{+j\beta_1 z})}{2}$$

$$= \hat{a}_y \frac{E_{i0}}{\eta_1} 2\cos(\beta_1 z)$$

$$\overline{\mathscr{E}}_1(z;t) = \mathrm{Re}\{\overline{E}_1(z) e^{j\omega t}\}$$

$$= \mathrm{Re}\{-\hat{a}_x 2jE_{i0} \sin(\beta_1 z) e^{j\omega t}\}$$

$$= \mathrm{Re}\{-\hat{a}_x 2jE_{i0} \sin(\beta_1 z)[\cos(\omega t) + j\sin(\omega t)]\}$$

$$= \mathrm{Re}\{-\hat{a}_x 2jE_{i0} \sin(\beta_1 z)\cos(\omega t) - \hat{a}_x 2j^2 E_{i0} \sin(\beta_1 z)\sin(\omega t)\}$$

$$= \mathrm{Re}\{-\hat{a}_x 2jE_{i0} \sin(\beta_1 z)\cos(\omega t) + \hat{a}_x 2E_{i0} \sin(\beta_1 z)\sin(\omega t)\}$$

$$= \hat{a}_x 2E_{i0} \sin(\beta_1 z)\sin(\omega t)$$

$$\overline{\mathscr{H}}_1(z;t) = \text{Re}\{\overline{H}_1(z)e^{j\omega t}\}$$

$$= \text{Re}\{\hat{a}_y \frac{E_{i0}}{\eta_1} 2\cos(\beta_1 z)e^{j\omega t}\}$$

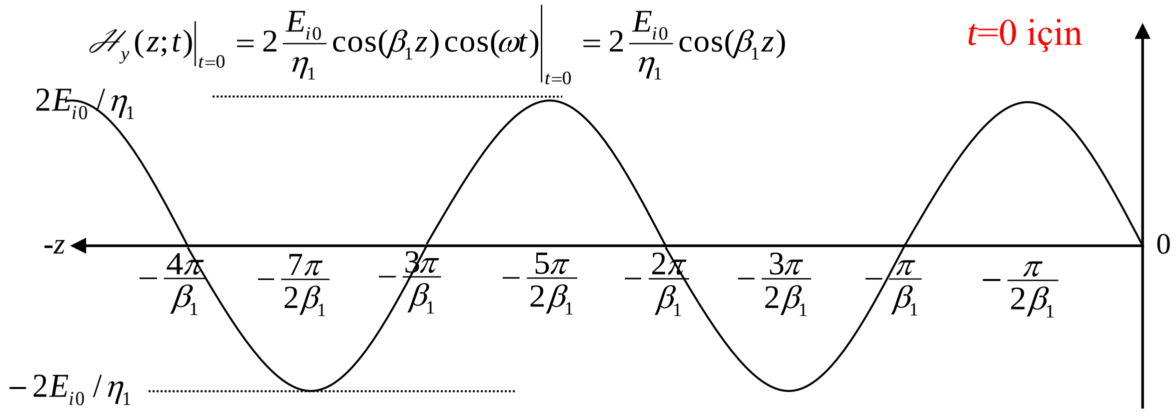
$$= \text{Re}\{\hat{a}_y \frac{E_{i0}}{\eta_1} 2\cos(\beta_1 z)[\cos(\omega t) + j\sin(\omega t)]\}$$

$$= \text{Re}\{\hat{a}_y \frac{E_{i0}}{\eta_1} 2\cos(\beta_1 z)\cos(\omega t) + j\hat{a}_y \frac{E_{i0}}{\eta_1} 2\cos(\beta_1 z)\sin(\omega t)\}$$

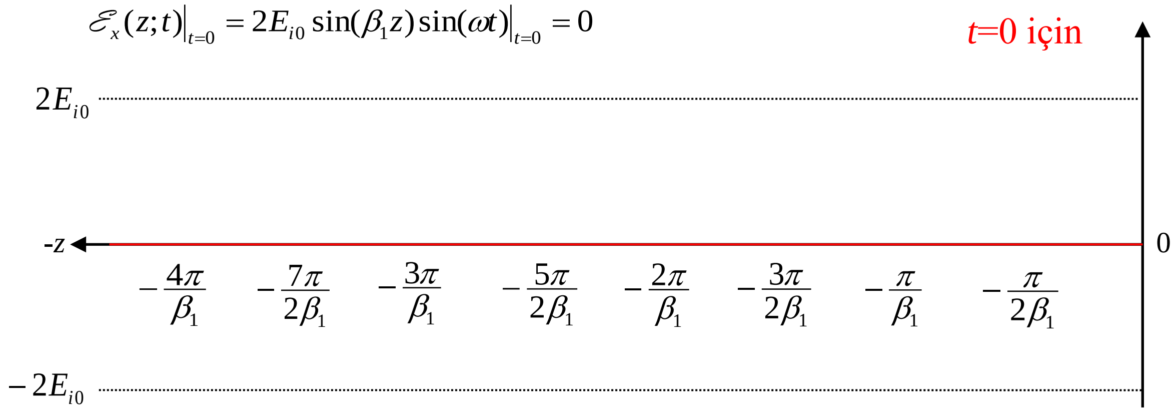
$$= \hat{a}_y 2\frac{E_{i0}}{\eta_1}\cos(\beta_1 z)\cos(\omega t)$$

Elektrik alan ve manyetik alan, hem zamansal, hem de konumsal olarak ters fazlıdır.

$$\mathscr{H}_y(z;t)\Big|_{t=0} = 2\frac{E_{i0}}{\eta_1}\cos(\beta_1 z)\cos(\omega t)\Big|_{t=0} = 2\frac{E_{i0}}{\eta_1}\cos(\beta_1 z)$$

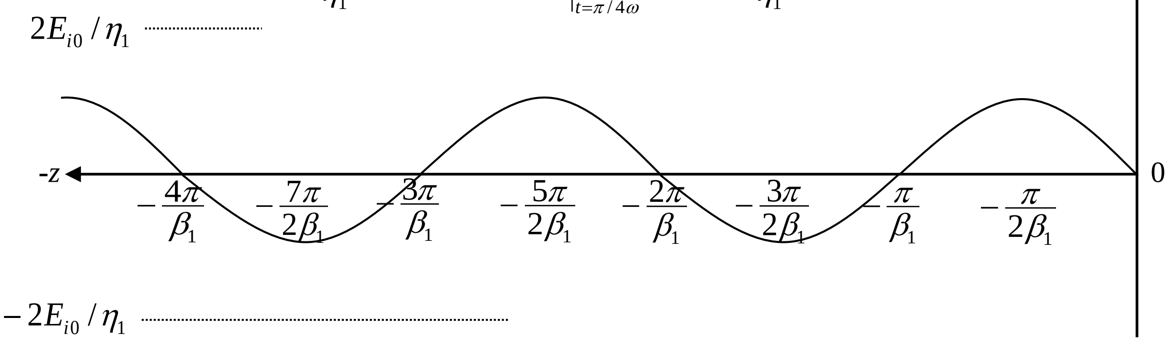


$$\mathscr{E}_x(z;t)\Big|_{t=0} = 2E_{i0}\sin(\beta_1 z)\sin(\omega t)\Big|_{t=0} = 0$$



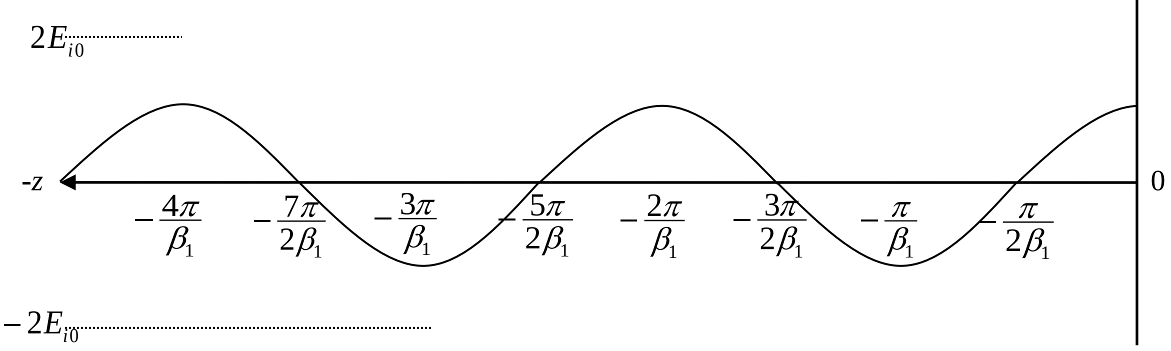
$$\mathscr{H}_y(z;t)\Big|_{t=\pi/4\omega} = 2\frac{E_{i0}}{\eta_1}\cos(\beta_1 z)\cos(\omega t)\Big|_{t=\pi/4\omega} = 1.414\frac{E_{i0}}{\eta_1}\cos(\beta_1 z)$$

$t=\pi/4\omega$ için

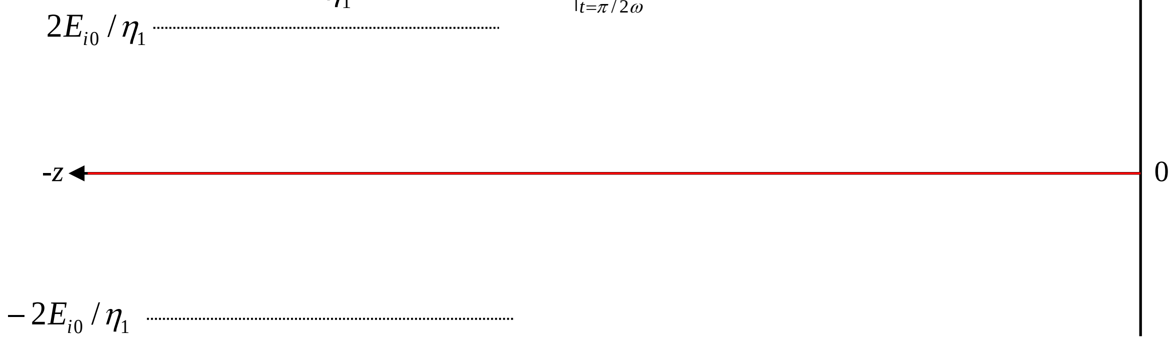


$$\mathscr{E}_x(z;t)\Big|_{t=\pi/4\omega} = 2E_{i0}\sin(\beta_1 z)\sin(\omega t)\Big|_{t=\pi/4\omega} = 1.414E_{i0}\sin(\beta_1 z)$$

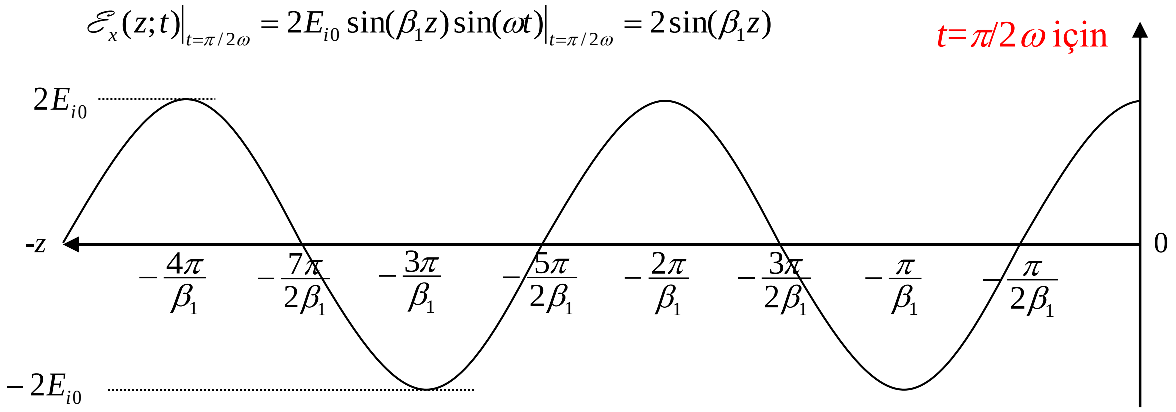
$t=\pi/4\omega$ için



$$\mathscr{H}_y(z;t)\Big|_{t=\pi/2\omega} = 2\frac{E_{i0}}{\eta_1}\cos(\beta_1 z)\cos(\omega t)\Big|_{t=\pi/2\omega} = 0$$



$$\mathscr{E}_x(z;t)\Big|_{t=\pi/2\omega} = 2E_{i0}\sin(\beta_1 z)\sin(\omega t)\Big|_{t=\pi/2\omega} = 2\sin(\beta_1 z)$$



$$u_{p1} = \frac{\omega}{\beta_1} = \frac{2\pi f}{\beta_1}$$

$$u_{p1} = \lambda_1 f = \frac{2\pi f}{\beta_1}$$

$$\Rightarrow \lambda_1 = \frac{2\pi}{\beta_1}$$