05.05.23.

Problem 3.

$H(0) = f_1$

$H(z_{max}) = f_2$

$$\det = \frac{-\sigma \cdot sh(k \cdot z_{max})}{k}$$

$$\underbrace{\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}}_{A}\begin{pmatrix} H(0) \\ B(0) \end{pmatrix} + \underbrace{\begin{pmatrix} 0 & 0 \\ 1 & 0 \end{pmatrix}}_{B}\begin{pmatrix} H(z_{max}) \\ B(z_{max}) \end{pmatrix} = \begin{pmatrix} f_1 \\ f_2 \end{pmatrix}$$

$$\det\left(\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} + \begin{pmatrix} 0 & 0 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} ch(kz_m) & -\frac{\sigma}{k} sh(kz_m) \\ \frac{i\omega\mu_0}{k} sh(kz_m) & ch(kz_m) \end{pmatrix}\right) =$$

$$= \det\left(\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} + \begin{pmatrix} 0 & 0 \\ ch(kz_m) & -\frac{\sigma}{k} sh(kz_m) \end{pmatrix}\right) =$$

$$= \det\begin{pmatrix} 1 & 0 \\ ch(kz_m) & -\frac{\sigma}{k} sh(kz_m) \end{pmatrix} = -\frac{\sigma}{k} sh(kz_m)$$

$$(A + Be^{z_m L})\overline{X} = \overline{F} = \begin{pmatrix} f_1 \\ f_2 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 \\ ch(kz_m) & -\frac{\sigma}{k} sh(kz_m) \end{pmatrix}\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} f_1 \\ f_2 \end{pmatrix}$$

$x_1 = f_1$

$x_1 ch(kz_m) - x_2 \frac{\sigma}{k} sh(kz_m) = f_2$

$$x_2 = \frac{f_1 ch(kz_m) - f_2}{\frac{\sigma}{k} sh(kz_m)}$$

~~$\overline{U}(z) = e^{zL}\overline{X}$~~ $\overline{U}(z) = e^{zL} \cdot \overline{X}$

$$\vec{J}(z) = \begin{pmatrix} ch(kz_m) & -\frac{\sigma}{k} sh(kz_m) \\ \frac{i\omega\mu_0}{k} sh(kz_m) & ch(kz_m) \end{pmatrix} \begin{pmatrix} f_1 \\ \frac{f_1 ch(kz_m) - f_2}{\frac{\sigma}{k} sh(kz_m)} \end{pmatrix} = \begin{pmatrix} H(z) \\ E(z) \end{pmatrix}$$

$$H(z) = f_1 \cdot ch(kz_m) + \cancel{f_2 sh(kz_m)} \; f_2 - f_1 ch(kz_m) = f_2$$

$$E(z) = f_1 \frac{i\omega\mu_0}{k} sh(kz_m) + ch(kz_m)\left[\frac{f_1 ch(kz_m) - f_2}{\frac{\sigma}{k} sh(kz_m)}\right] =$$

$$= f_1 \frac{i\omega\mu_0}{k} sh(kz_m) + \frac{k}{\sigma} ch(kz_m)\left[\frac{f_1 ch(kz_m) - f_2}{sh(kz_m)}\right] =$$

$$= f_1 \frac{i\omega\mu_0}{k} sh(kz_m) + \frac{k}{\sigma}\left[f_1 cth(kz_m) \cdot ch(kz_m) - f_2 \cdot cth(kz_m)\right]$$

$$k = (1-i)\sqrt{\frac{\omega\mu_0\sigma}{2}}$$

$$H(z) = f_1 \cdot ch(kz) + \frac{sh(kz_m)(f_2 - f_1 ch(kz_m))}{sh(kz_m)}$$

$$E(z) = f_1 \cdot \frac{i\omega\mu_0}{k} sh(kz) + \frac{ch(kz)(f_1 ch(kz_m) - f_2)}{\frac{\sigma}{k} sh(kz_m)}$$