	P	T	PT
ρ	+	+	+
ρ_m	−	−	+
$\bar{J}$	−	−	+
$\bar{J}_m$	+	+	+
$\bar{E}$	−	+	−
$\bar{H}$	+	−	−
$\bar{D}$	−	+	−
$\bar{B}$	+	−	−
$\bar{\bar{\varepsilon}}$	+	+	+
$\bar{\bar{\mu}}$	+	+	+
$\bar{\bar{\xi}}$	−	−	+
$\bar{\bar{\zeta}}$	−	−	+

$$\nabla \times \bar{H} = \bar{J} + \frac{\partial \bar{D}}{\partial t}$$

$$\nabla \times \bar{E} = -\bar{J}_m - \frac{\partial \bar{B}}{\partial t}$$

$$\nabla \cdot \bar{D} = \rho$$

$$\nabla \cdot \bar{B} = \rho_m$$

$$\bar{D} = \bar{\bar{\varepsilon}} \cdot \bar{E} + \bar{\bar{\xi}} \cdot \bar{H}$$

$$\bar{B} = \bar{\bar{\mu}} \cdot \bar{H} + \bar{\bar{\zeta}} \cdot \bar{E}$$

$$\bar{J} = \rho \frac{d\bar{r}}{dt}$$

$$\bar{J}_m = \rho_m \frac{d\bar{r}}{dt}$$

$t \to -t \qquad t_T = -t$

$\bar{j}_T = -\bar{j}$

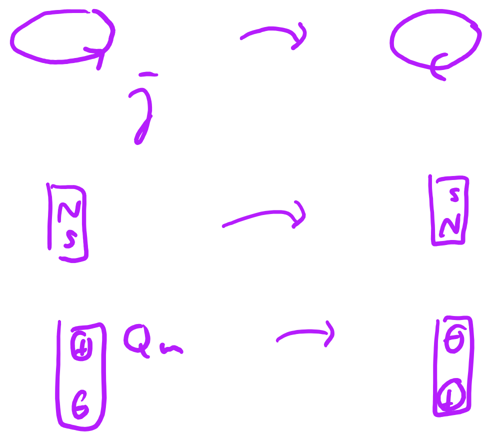
$\bar{j} = \rho \frac{d\bar{r}}{dt}$

$\nabla \times \bar{H} = \bar{j} + \frac{\partial \bar{D}}{\partial t}$

$\bar{j}_m = \rho_m \frac{d\bar{r}}{dt}$

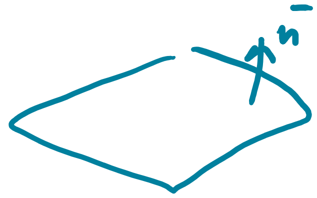
$\nabla \cdot \bar{D} = \rho$

$\bar{j} \to -\bar{j}$



$\bar{\rho}_m \to -\bar{\rho}_m$

$$\bar{\bar{Z}}_s = Z_1 \bar{\bar{I}}_t + Z_2 \underbrace{\bar{\bar{J}}}_{\bar{n}\times\bar{\bar{I}}}$$



$$\bar{E}_t = \bar{\bar{Z}}_s \cdot \bar{n}\times\bar{H}_t$$

$$\bar{S}_{11} = \frac{1}{2}\bar{E}_t \times \bar{H}_t^* = \frac{1}{2}\left[\bar{\bar{Z}}_s \cdot \bar{n}\times\bar{H}_t\right]\times\bar{H}_t^*$$

$$= \frac{1}{2}\left[Z_1 \bar{n}\times\bar{H}_t + Z_2\, \underbrace{\bar{n}\times(\bar{n}\times\bar{H}_t)}_{\bar{n}\,\underbrace{\bar{n}\cdot\bar{H}_t}_{0} - \underbrace{\bar{n}\cdot\bar{n}}_{1}\,\bar{H}_t}\right]\times\bar{H}_t^*$$

$$= \frac{1}{2}Z_1\left(\bar{H}_t\,\overbrace{\bar{n}\cdot\bar{H}_t^*}^{=0} - \bar{n}\,\bar{H}_t\cdot\bar{H}_t^*\right) - \frac{1}{2}Z_2\,\bar{H}_t\times\bar{H}_t^*$$

$$= -\frac{1}{2}Z_1\bar{n}\,|\bar{H}_t|^2 - \frac{1}{2}Z_2\,\bar{H}_t\times\bar{H}_t^*$$

LOSSLESS BOUNDARY: $\mathrm{Re}\{\bar{n}\cdot\bar{S}\} = 0$

$$\mathrm{Re}\{Z_1\} = 0 \quad , \quad \mathrm{Im}\{Z_2\} = 0$$

$$(\bar{H}_t\times\bar{H}_t^*)^* = \bar{H}_t^*\times\bar{H}_t = -\underbrace{\bar{H}_t\times\bar{H}_t^*}_{\text{PURE IMAG.}}$$

$$\bar{S}_T(t) = -\bar{S}(-t)$$

$$\bar{S} = \frac{1}{2}\bar{E}\times\bar{H}^*$$

$$\bar{S}_T = -\bar{S} = -\frac{1}{2}\bar{E}\times\bar{H}^*$$

$$\bar{S}_T(\omega) = -\frac{1}{2}\bar{E}(\omega)\times\bar{H}^*(\omega) = -\bar{S}(\omega)$$

$$\bar{S}_T(\omega) = \frac{1}{2}\bar{E}_T(\omega)\times\bar{H}_T^*(\omega) = \frac{1}{2}\bar{E}(-\omega)\times\bar{H}^*(-\omega)$$

$$= \bar{S}(-\omega)$$

$$(4.7) \quad \bar{S}_T(\omega) = -\bar{S}^*(-\omega)$$

$f(t)$

$$F(\omega) = \int_{-\infty}^{\infty} f(t)\, e^{-j\omega t}\, dt$$

$t' = -t$

$dt' = -dt$

$$F^*(\omega) = \int_{-\infty}^{\infty} f(t)\, e^{+j\omega t}\, dt$$

$$= -\int_{+\infty}^{-\infty} f(-t')\, e^{-j\omega t'}\, dt'$$

$$= \int_{-\infty}^{\infty} f(-t')\, e^{-j\omega t'}\, dt' = -F(\omega)$$

$$\Rightarrow \quad f(t) = -f(-t)$$

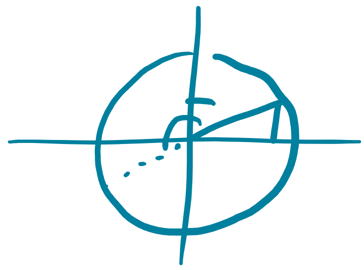
4.1

$$\begin{pmatrix}\bar{E}\\ \bar{H}\end{pmatrix}_d = T(\alpha)\begin{pmatrix}\bar{E}\\ \bar{H}\end{pmatrix}$$

$$T(\alpha) = \frac{1}{\sqrt{1-\sin 2\alpha}}\begin{pmatrix}1 & \sqrt{2}\sin\alpha\,\eta_0\\ \frac{\sqrt{2}}{\eta_0}\cos\alpha & 1\end{pmatrix}$$

$\det T = ?$ $\qquad\qquad$ $T^{-1} = ?$

$$\det T = \frac{1}{\sqrt{}^{\,2}}\Big(1 - \underbrace{\frac{\sqrt{2}}{\eta_0}\sqrt{2}\,\eta_0 \sin\alpha\cos\alpha}_{2\sin\alpha\cos\alpha\ =\ \sin 2\alpha}\Big) = 1$$



$$\begin{pmatrix}a & b\\ c & d\end{pmatrix}^{-1} = \frac{1}{ad-bc}\begin{pmatrix}d & -b\\ -c & a\end{pmatrix}$$

$$T^{-1} = \frac{1}{\sqrt{}}\begin{pmatrix}1 & -\sqrt{2}\,\eta_0\sin\alpha\\ -\frac{\sqrt{2}}{\eta_0}\cos\alpha & 1\end{pmatrix}$$

$$\sin(\alpha+\pi) = \sin\alpha\cos\pi + \cos\alpha\sin\pi = -\sin\alpha$$

$$\cos(\alpha+\pi) = \cos\alpha\cos\pi - \sin\alpha\sin\pi = -\cos\alpha$$

$$T^{-1}(\alpha) = T(\alpha+\pi)$$

$$\bar{D} = \bar{\bar{\varepsilon}}\cdot\bar{E} + \bar{\bar{\xi}}\cdot\bar{H}$$

$$\nabla\times\bar{E} = -j\omega\bar{B}$$

$$\nabla\times\bar{E}_d = -j\omega\bar{B}_d$$

$$\nabla\times\frac{1}{\sqrt{}}\left(\bar{E} + \sqrt{2}\,\eta_0\sin\alpha\,\bar{H}\right) = -j\omega\bar{B}_d$$

$$\frac{1}{\sqrt{}}\nabla\times\bar{E} + \frac{\sqrt{2}\,\eta_0\sin\alpha}{\sqrt{}}\nabla\times\bar{H} = -j\omega\bar{B}_d$$

$$\frac{1}{\sqrt{}}\left(-j\omega\bar{B}\right) + \frac{\sqrt{2}\,\eta_0 \sin\alpha}{\sqrt{}}\left(j\omega\bar{D}\right) = -j\omega\bar{B}_d$$

$$\bar{B}_d = \frac{1}{\sqrt{}}\,\bar{B} - \frac{\sqrt{2}\,\eta_0 \sin\alpha}{\sqrt{}}\,\bar{D}$$

etc...