Today: still from Chillwell

Tomorrow: optical interometers and resonators {wikipedia}

How to get $u(x) \Rightarrow (E_z(TE), H_z(TM))$ using Chillwells coords)

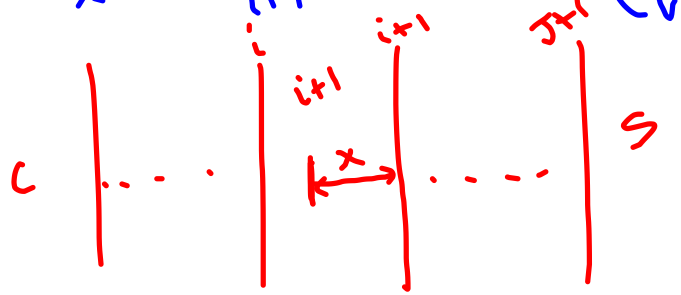
Revisit what our good old matrix M is.

$$\begin{pmatrix} u_i \\ v_i \end{pmatrix} = M_{i+1} \begin{pmatrix} u_{i+1} \\ v_{i+1} \end{pmatrix}$$

Let's write out some dependencies

$$M_{i+1} = M(\epsilon_{i+1}, \mu_{i+1}, \underset{\substack{\uparrow \\ \text{thickness}}}{h_{i+1}}, \beta)$$

Instead of using h_{i+1}, you can use $x < h_{i+1}$ to find $\begin{pmatrix} u(x_{i+1}-x) \\ v(x_{i+1}-x) \end{pmatrix} = M(\epsilon_{i+1}, \mu_{i+1}, x, \beta) \cdot \begin{pmatrix} u_{i+1} \\ v_{i+1} \end{pmatrix}$



HW 1(a)

Show $v = \frac{\gamma}{i k \alpha} \frac{du}{dx}$; $w = \cdots$ $u = \cdots$

TE: $u = E_z$, $\gamma = \alpha/z$, $v = -H_y$

Max (3): $\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t} = -\mu \frac{\partial \vec{H}}{\partial t} = +i\omega\mu \vec{H}$

$TE \Rightarrow E_{x,y} = \emptyset$

$\vec{\nabla} \times \vec{E} = +\frac{\partial E_z}{\partial y}\hat{x} - \frac{\partial E_z}{\partial x}\hat{y} = +i\omega\mu\vec{H}$

$\Rightarrow H_z = \emptyset$

$\frac{\partial E_z}{\partial y}\hat{x} - \frac{\partial E_z}{\partial x}\hat{y} = i\omega\mu(H_x\hat{x} + H_y\hat{y})$

$-\frac{\partial E_z}{\partial x} = i\omega\mu H_y$

$E_z = u$; $v = -H_y$

$-\frac{\partial u}{\partial x} = -i\omega\mu v$

$k = \frac{\omega}{v} = \omega\sqrt{\mu\epsilon}$

$\Rightarrow v = \frac{1}{i\omega\mu}\frac{du}{dx}$

$\Rightarrow \omega = \frac{k}{\sqrt{\mu\epsilon}}$

$v = \frac{\sqrt{\mu\epsilon}}{ik\mu}\frac{du}{dx}$

$$\boxed{v = \frac{1}{ik\sqrt{\mu/\epsilon}}\frac{du}{dx}}$$

$u, v, w = u, v, w(x)\, e^{i(k\beta y - \omega t)}$

No z-dependence

$$u^{+}(x,y) = u_0 e^{i(k\alpha x + k\beta y - \omega t)}$$

$$= u_0 e^{i(\vec{k}\cdot\vec{r} - \omega t)}$$

$$\vec{k} = k\alpha\hat{x} + k\beta\hat{y}$$