

CURRENT SOURCE (Added Source)

ID TE

$$\textcircled{1} \quad \nabla \times \bar{E} = -\mu \frac{\partial \bar{H}}{\partial t} - \bar{M}_s \quad \bar{M}_s = -\hat{n} \times \bar{E}^{inc}$$

$$\textcircled{2} \quad \nabla \times \bar{H} - \sigma \bar{E} = \epsilon \frac{\partial \bar{E}}{\partial t} + \bar{J}_s \quad \bar{J}_s = \hat{n} \times \bar{H}^{inc}$$

$$\textcircled{1} \quad \begin{vmatrix} \hat{x} & -\hat{y} & \hat{z} \\ \frac{\partial}{\partial x} & 0 & 0 \\ 0 & E_y & 0 \end{vmatrix} = -\mu \frac{\partial H_z}{\partial t} - \bar{M}_{sz} \quad \begin{matrix} \bar{M}_s \uparrow \\ \bar{J}_s \uparrow \end{matrix} \rightarrow \hat{n} = \hat{x}$$

$$\frac{\partial E_y}{\partial x} - E_y^{inc} = -\mu \frac{\partial H_z}{\partial t}$$

$$* \left\{ \begin{aligned} H_z^{n+1/2}(i+1/2) &= H_z^{n-1/2}(i+1/2) - \frac{\Delta t}{\mu \Delta x} [E_y^n(i+1) - E_y^n(i)] \\ &\quad + \left(\frac{\Delta t}{\mu} \right) E_y^{inc\ n}(i+1/2) \end{aligned} \right.$$

Regular FDTD update ey const Add later

$$\textcircled{2} \quad -\frac{\partial H_z}{\partial x} - \sigma E_y = \epsilon \frac{\partial E_y}{\partial t} - H_z^{inc}$$

$$\begin{aligned} & \frac{-1}{\epsilon \Delta x} [H_z^{n+1/2}(i+1/2) - H_z^{n+1/2}(i-1/2)] - \frac{\sigma}{\epsilon} \left[\frac{E_y^{n+1}(i) + E_y^n(i)}{2} \right] \\ &= \frac{E_y^{n+1}(i) - E_y^n(i)}{\Delta t} - \left(\frac{1}{\epsilon} \right) H_z^{inc\ n+1/2}(i) \end{aligned}$$

$$* \left\{ \begin{aligned} E_y^{n+1}(i) &= E_y^n(i) \left[\frac{1 + \frac{\sigma \Delta t}{2\epsilon}}{1 + \frac{\sigma \Delta t}{2\epsilon}} \right] + \frac{\Delta t}{2\epsilon \Delta x} [H_z^{n+1/2}(i+1/2) - H_z^{n+1/2}(i-1/2)] \\ &\quad + \left(\frac{1}{\epsilon} \right) \frac{H_z^{inc\ n+1/2}(i)}{[1 + \frac{\sigma \Delta t}{2\epsilon}]} \end{aligned} \right.$$

Regular FDTD update hz const sin(wt)

0 FOR AIR

For simple added source use only E.
For plane wave going only one dir, use both.