(1)

(0) $\frac{\partial \rho}{\partial t} + \nabla J = 0$; — continuity equation

(1) $\frac{\partial E}{\partial t} - \nabla \times B = -J$; $\nabla \cdot (\nabla \times A) = 0$.

(2) $\frac{\partial B}{\partial t} + \nabla \times E = 0$;

(3) $\nabla \cdot E = \rho$;

(4) $\nabla \cdot B = 0$;

$\frac{\partial (\nabla \cdot E)}{\partial t} = -\nabla J = \frac{\partial \rho}{\partial t}$; [by $\nabla \cdot (1)$]

$\frac{\partial (\nabla \cdot B)}{\partial t} = \frac{\partial}{\partial t} 0 = 0$; [by $\nabla \cdot (2)$],

Hence, if (3) and (4) are true at $t = 0$, they are true for $t > 0$ as well.

(1*) $-\frac{\partial E}{\partial t} + \nabla \times B = 0$

(2*) $\frac{\partial B}{\partial t} + \nabla \times E = 0$;

$$\begin{pmatrix} (\mathrm{rot}\, F)_x \\ (\mathrm{rot}\, F)_y \\ (\mathrm{rot}\, F)_z \end{pmatrix} = \begin{pmatrix} \frac{\partial F_z}{\partial y} - \frac{\partial F_y}{\partial z} \\ \frac{\partial F_x}{\partial z} - \frac{\partial F_z}{\partial x} \\ \frac{\partial F_y}{\partial x} - \frac{\partial F_x}{\partial y} \end{pmatrix}$$

- $$\frac{E_x^{n+1,i,j,k}-E_x^{n,i,j,k}}{\Delta t}+\frac{B_z^{n,i,j,k}-B_z^{n,i,j-1,k}}{h_y}-\frac{B_y^{n,i,j,k}-B_y^{n,i,j,k-1}}{h_z}=0,$$

- $$\frac{E_y^{n+1,i,j,k}-E_y^{n,i,j,k}}{\Delta t}+\frac{B_x^{n,i,j,k}-B_x^{n,i,j,k-1}}{h_z}-\frac{B_z^{n,i,j,k}-B_z^{n,i-1,j,k}}{h_x}=0,$$

- $$\frac{E_z^{n+1,i,j,k}-E_z^{n,i,j,k}}{\Delta t}+\frac{B_y^{n,i,j,k}-B_y^{n,i-1,j,k}}{h_x}-\frac{B_x^{n,i,j,k}-B_x^{n,i,j-1,k}}{h_y}=0,$$

$$\frac{B_x^{n+1,i,j,k}-B_x^{n,i,j,k}}{\Delta t}+\frac{E_z^{n,i,j,k}-E_z^{n,i,j-1,k}}{h_y}-\frac{E_y^{n,i,j,k}-E_y^{n,i,j,k-1}}{h_z}=0,$$

$$\frac{B_y^{n+1,i,j,k}-B_y^{n,i,j,k}}{\Delta t}+\frac{E_x^{n,i,j,k}-E_x^{n,i,j,k-1}}{h_z}-\frac{E_z^{n,i,j,k}-E_z^{n,i-1,j,k}}{h_x}=0,$$

$$\frac{B_z^{n+1,i,j,k}-B_z^{n,i,j,k}}{\Delta t}+\frac{E_y^{n,i,j,k}-E_y^{n,i-1,j,k}}{h_x}-\frac{E_x^{n,i,j,k}-E_x^{n,i,j-1,k}}{h_y}=0,$$

$$E_x^{n+1,i,j,k} = E_x^{n,i,j,k} + \Delta t\left[\frac{B_z - \tilde{B}_z}{h_y} + \frac{\tilde{B}_y - \tilde{B}_y}{h_z}\right]$$

$$E_y^{n+1,i,j,k} = E_y^{n,i,j,k} + \Delta t\left[\frac{\tilde{B}_x - \tilde{B}_x}{h_z} + \frac{\tilde{B}_z - \tilde{B}_z}{h_x}\right]$$

$$E_z^{n+1,i,j,k} = E_z^{n,i,j,k} + \Delta t\left[\frac{\tilde{B}_y - \tilde{B}_y}{h_x} + \frac{\tilde{B}_x - \tilde{B}_x}{h_y}\right]$$

$$B_x^{n+1,i,j,k} = B_x^{n,i,j,k} - \Delta t\left[\frac{\tilde{E}_z - \tilde{E}_z}{h_y} + \frac{\tilde{E}_y - \tilde{E}_y}{h_z}\right]$$

$$B_y^{n+1,i,j,k} = B_y^{n,i,j,k} - \Delta t\left[\frac{\tilde{E}_x - \tilde{E}_x}{h_z} + \frac{\tilde{E}_z - \tilde{E}_z}{h_x}\right]$$

$$B_z^{n+1,i,j,k} = B_z^{n,i,j,k} - \Delta t\left[\frac{\tilde{E}_y - \tilde{E}_y}{h_x} + \frac{\tilde{E}_x - \tilde{E}_x}{h_y}\right]$$