

$$\frac{\beta}{k_o} E_x(i, j) = H_y(i, j) + \frac{j}{k_o \, \mathrm{d}x(i)} [E_z(i + 1, j) - E_z(i, j)]$$

$$\frac{\beta}{k_o} E_x(i, j) = H_y(i, j) + \frac{j}{k_o \text{d}\mathbf{x}(i)} \left[\frac{-j}{k_o \text{d}\mathbf{x}(i) \varepsilon_{zz}(i+1, j)} [H_y(i+1, j) - H_y(i, j)] + \frac{j}{k_o \text{d}\mathbf{y}(j-1) \varepsilon_{zz}(i+1, j)} [H_x(i+1, j) - H_x(i+1, j-1)] - \left(\frac{-j}{k_o \text{d}\mathbf{x}(i-1) \varepsilon_{zz}(i, j)} [H_y(i, j) - H_y(i-1, j)] + \frac{j}{k_o \text{d}\mathbf{y}(j-1) \varepsilon_{zz}(i, j)} [H_x(i, j) - H_x(i, j-1)] \right) \right]$$

$$\mathrm{d}x(i) = \frac{\mathrm{d}x(i) + \mathrm{d}x(i+1)}{2} \qquad \mathrm{d}y(j) = \frac{\mathrm{d}y(j) + \mathrm{d}y(j+1)}{2}$$

$$\frac{\beta}{k_o} E_x(i, j) = H_y(i, j) + \frac{1}{k_o^2 \text{d}\mathbf{x}(i) \text{d}\mathbf{x}(i) \varepsilon_{zz}(i+1, j)} [H_y(i+1, j) - H_y(i, j)] - \frac{1}{k_o^2 \text{d}\mathbf{x}(i) \text{d}\mathbf{y}(j-1) \varepsilon_{zz}(i+1, j)} [H_x(i+1, j) - H_x(i+1, j-1)] - \frac{1}{k_o^2 \text{d}\mathbf{x}(i-1) \text{d}\mathbf{x}(i) \varepsilon_{zz}(i, j)} [H_y(i, j) - H_y(i-1, j)] + \frac{1}{k_o^2 \text{d}\mathbf{x}(i) \text{d}\mathbf{y}(j-1) \varepsilon_{zz}(i, j)} [H_x(i, j) - H_x(i, j-1)]$$

$$\frac{\partial}{\partial k_0} E_y(i, j) = E_x(i, j) + \frac{j}{k_0 dy(j)} [E_z(i, j+1) - E_z(i, j)]$$

$$\frac{\beta}{k_o} E_y(i, j) = -H_x(i, j) + \frac{j}{k_o \, \mathrm{d}y(j)} \left[\frac{-j}{k_o \, \mathrm{d}x(i-1) \varepsilon_{zz}(i, j+1)} [H_y(i, j+1) - H_y(i-1, j+1)] + \frac{j}{k_o \, \mathrm{d}y(j) \varepsilon_{zz}(i, j)} [H_x(i, j+1) - H_x(i, j)] - \left(\frac{-j}{k_o \, \mathrm{d}x(i-1) \varepsilon_{zz}(i, j)} [H_y(i, j) - H_y(i-1, j)] + \frac{j}{k_o \, \mathrm{d}y(j-1) \varepsilon_{zz}(i, j)} [H_x(i, j) - H_x(i, j-1)] \right) \right]$$

$$\frac{\beta}{k_o} E_y(i, j) - H_x(i, j) + \frac{1}{k_o^2 d_y(j) d d x(i-1) \epsilon_{zz}(i, j+1)} [H_y(i, j+1) - H_y(i-1, j+1)] - \frac{1}{k_o^2 d_y(j) d d y(j) \epsilon_{zz}(i, j)} [H_x(i, j+1) - H_x(i, j)] - \frac{1}{k_o^2 d_y(j) d d x(i-1) \epsilon_{zz}(i, j)} [H_y(i, j) - H_y(i-1, j)] + \frac{1}{k_o^2 d_y(j) d d y(j-1) \epsilon_{zz}(i, j)} [H_x(i, j) - H_x(i, j-1)] \Bigg)$$

$$H' = H\sqrt{\eta_0} \qquad E' = \frac{E}{\sqrt{\eta_0}}$$