

$$\frac{\partial x}{\partial z} = \frac{eB_0 \cosh(K_y Y)}{\gamma m c K_y} \left[\left(\frac{-y_0 K_u K_y \sinh(K_y Y)}{(K_u^2 - K_y^2)} \right) (K_u \sin(K_u Z) \sin(K_y Z) + K_y \cos(K_u Z) \cos(K_y Z)) \right. \\ \left. + \left(\frac{y_0 K_u \sinh(K_y Y)}{(K_u^2 - K_y^2)} \right) (K_u \sin(K_u Z) \cos(K_y Z) - K_y \cos(K_u Z) \sin(K_y Z)) \right] \\ + \frac{K_y}{K_u} \cosh(K_y Y) \cos(K_u Z)$$

$$\frac{\partial x^2}{\partial z^2} \Rightarrow K_u \frac{d}{dz} \sin(K_u Z) \sin(K_y Z) = K_u K_y \sin(K_u Z) (\cos(K_y Z) + K_u^2 \cos(K_u Z) \sin(K_y Z)) \\ K_y \frac{d}{dz} \cos(K_u Z) \cos(K_y Z) = -K_y K_u \sin(K_u Z) \cos(K_y Z) + K_y^2 \cos(K_u Z) \sin(K_y Z)$$

$$K_u \frac{d}{dz} \sin(K_u Z) \cos(K_y Z) = K_u^2 \cos(K_u Z) \cos(K_y Z) - K_u K_y \sin(K_u Z) \sin(K_y Z)$$

$$K_y \frac{d}{dz} \cos(K_u Z) \sin(K_y Z) = K_y^2 \cos(K_u Z) \cos(K_y Z) - K_u K_y \sin(K_u Z) \sin(K_y Z)$$

$$\frac{K_y}{K_u} \frac{d}{dz} \cos(K_u Z) = -K_y \sin(K_u Z)$$

$$\frac{\partial x^2}{\partial z^2} = \left(\frac{eB_0 \cosh(K_y Y)}{\gamma m c K_y} \right) \left[\left(\frac{-y_0 K_u K_y \sinh(K_y Y)}{(K_u^2 - K_y^2)} \right) (K_u^2 - K_y^2) (\cos(K_u Z) \sin(K_y Z)) \right. \\ \left. + \left(\frac{y_0 K_u \sinh(K_y Y)}{(K_u^2 - K_y^2)} \right) ((K_u^2 - K_y^2) (\cos(K_u Z) \cos(K_y Z) - 2 K_u K_y \sin(K_u Z) \sin(K_y Z))) \right] \\ - K_y \cosh(K_y Y) \sin(K_u Z)$$

$$\frac{\partial x^2}{\partial z^2} = \left(\frac{eB_0 \cosh(K_y Y)}{\gamma m c K_y} \right) \left[(-y_0 K_u K_y \sinh(K_y Y) \cos(K_u Z) \sin(K_y Z)) \right. \\ \left. + \left(\frac{y_0 K_u \sinh(K_y Y)}{(K_u^2 - K_y^2)} \right) ((K_u^2 - K_y^2) \cos(K_u Z) \cos(K_y Z) - 2 K_u K_y \sin(K_u Z) \sin(K_y Z)) \right] \\ - K_y \cosh(K_y Y) \sin(K_u Z)$$