V_3 Page 1

$$y = y_\beta = y_0 \cos(K_{ny} Z) + \frac{y_0'}{K_{ny}} \sin(K_{ny} Z) \quad (5.23)$$

$$\frac{dZ}{dt} = c$$

$$\frac{dy}{dz} = -y_0 K_{ny} \sin(K_{ny} Z) + y_0' \cos(K_{ny} Z)$$

$$\frac{d^2 y(z)}{dz^2} = -K_{ny}^2 y(z) \qquad z = ct \Rightarrow \frac{d^2 y(t)}{dt^2} = -K_{ny}^2 c^2 y(ct)$$

$$\frac{dy}{dZ} = \frac{dy}{dt}\Big/c \qquad \frac{dy}{dt} = c\frac{dy}{dz}$$

$$\vec{B} = -\frac{B_0}{K_y} K_x \sinh(K_x X) \sinh(K_y Y) \sin(K_u Z)\, \hat{x} + -\frac{B_0}{K_y} K_y \cosh(K_x X) \cosh(K_y Y) \sin(K_u Z)\, \hat{y} + -\frac{B_0}{K_y} K_u \cosh(K_x X) \sinh(K_y Y) \cos(K_u Z)\, \hat{z} \quad (5.22)$$

$$\left(B_z \frac{dy}{dt} - B_y \frac{dZ}{dt}\right) = \frac{-\gamma m}{e} \frac{d}{dt}\frac{dx}{dt} \quad (5.17)$$

$$-\frac{B_0}{K_y} K_u \cosh(K_x X) \sinh(K_y Y) \cos(K_u z) \frac{dY}{dt} - \left(\frac{-B_0}{K_y}\right) K_y \cosh(K_x X) \cosh(K_y Y) \sin(K_u Z)\, c = \frac{-\gamma m}{e} \frac{d}{dt}\frac{dx}{dt}$$

$$K_u \sinh(K_y Y) \cos(K_u Z) \frac{dy}{dt} - K_y \cosh(K_y Y) \sin(K_u Z)\, c = \frac{K_y \gamma m}{e B_0 \cosh(K_x X)} \frac{d}{dt}\frac{dx}{dt}$$

$$c K_u \sinh(K_y Y)(\cos(K_u Z))\left[(-y_0 K_{ny} \sin(K_{ny} Z) + y_0' \cos(K_{ny} z)\right] - K_y \cosh(K_y Y) \sin(K_u Z)\, c =$$

$$-y_0 K_u K_n \sinh(K_y Y)(\cos(K_u Z)) \sin(K_{ny} Z) + y_0' K_u \sinh(K_y Y) \cos(K_u Z) \cos(K_{ny} Z) - K_y \cosh(K_y Y) \sin(K_u Z) = \frac{K_y \gamma m}{\cancel{c} e B_0 \cosh(K_x X)} \frac{d}{\cancel{dt}} \frac{dx}{dt} = \frac{K_y \gamma m}{e B_0 \cosh(K_x X)} \frac{d}{dz}\frac{dx}{dt}$$

$\int dZ$ Leftside

$$\int dZ \cos(K_u Z) \sin(K_{ny} Z) = \frac{K_u \sin(K_u Z) \sin(K_{ny} Z) + K_{ny} \cos(K_u Z) \cos(K_{ny} Z)}{K_u^2 - K_{ny}^2}$$

$$\int dz \cos(K_u z) \cos(K_{ny} Z) = \frac{K_u \sin(K_u Z) \cos(K_{ny} Z) - K_{ny} \cos(K_u Z) \sin(K_{ny} Z)}{K_u^2 - K_{ny}^2}$$

$$\int dz \sin(K_u Z) = -\frac{1}{K_u} \cos(K_u z)$$

$$\Bigg[\left[-y_0 K_u K_{ny} \sinh(K_y Y)\right] \left[\frac{K_u \sin(K_u z) \sin(K_{ny} Z) + K_{ny} \cos(K_u z) \cos(K_{ny} Z)}{K_u^2 - K_{ny}^2}\right] + y_0' K_u \sinh(K_y Y) \left[\frac{K_u \sin(K_u z) \cos(K_{ny} z) - K_{ny} \cos(K_u z) \sin(K_{ny} z)}{K_u^2 - K_{ny}^2}\right] + \frac{K_y}{K_u} \cosh(K_y Y) \cos(K_u z) \Bigg] \frac{e B_0 \cosh(K_x X)}{K_y \gamma m} = \frac{dx}{dt}$$