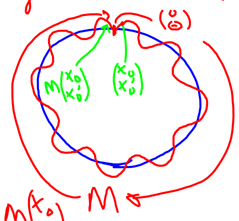
Finally:

$$x'' + \frac{(\gamma\beta)'}{\gamma\beta}x' + (K_x - K_{\delta x}\delta)x + S(1-\delta)y = \frac{\delta}{R} - \frac{\Delta B_{oy}}{RB_0} - \left(\frac{2}{R^2}\frac{\Delta B_{oy}}{B_0} + \frac{\Delta B_N'}{RB_0}\right)x - \frac{\Delta B_s'}{RB_0}y$$

$$y'' + \frac{(\gamma\beta)'}{\gamma\beta}y' + K_y(1-\delta)y + S(1-\delta)y = \frac{\Delta B_{ox}}{RB_0} + \frac{\Delta B_N'}{RB_0}y - \left(\frac{\Delta B_s'}{RB_0} - \frac{2\Delta B_{ox}}{R^2B_0}\right)x$$

Errors that change the closed orbit:



Just after kick have $\begin{pmatrix}x_0\\ x_0'\end{pmatrix}$

Then transport $\Rightarrow \begin{pmatrix}x\\ x'\end{pmatrix} = M\begin{pmatrix}x_0\\ x_0'\end{pmatrix}$

Then kick $\Rightarrow \begin{pmatrix}x\\ x'\end{pmatrix} + \begin{pmatrix}0\\ \Theta\end{pmatrix} = M\begin{pmatrix}x_0\\ x_0'\end{pmatrix} + \begin{pmatrix}0\\ \Theta\end{pmatrix}$

For closed orbit (periodic solution)

$$M\begin{pmatrix}x_0\\ x_0'\end{pmatrix} + \begin{pmatrix}0\\ \Theta\end{pmatrix} = \begin{pmatrix}x_0\\ x_0'\end{pmatrix} = I\begin{pmatrix}x_0\\ x_0'\end{pmatrix}$$

$$(I - M)\begin{pmatrix}x_0\\ x_0'\end{pmatrix} = \begin{pmatrix}0\\ \Theta\end{pmatrix}$$

$$(I - e^{\mu J})\begin{pmatrix}x_0\\ x_0'\end{pmatrix} = \begin{pmatrix}0\\ \Theta\end{pmatrix}$$

Note: $e^{(\mu_1+\mu_2)J} \stackrel{?}{=} e^{\mu_1 J}e^{\mu_2 J}$

$$e^{\mu_1 J}e^{\mu_2 J} = (I\cos\mu_1 + J\sin\mu_1)(I\cos\mu_2 + J\sin\mu_2)$$
$$= I(\cos\mu_1\cos\mu_2 - \sin\mu_1\sin\mu_2) + J(\sin\mu_1\cos\mu_2 + \cos\mu_1\sin\mu_2)$$
$$= I\cos(\mu_1+\mu_2) + J\sin(\mu_1+\mu_2)$$
$$= e^{(\mu_1+\mu_2)J}$$

$$\begin{pmatrix} 0 \\ 0 \end{pmatrix} = \left(I - e^{\mu J} \right) \begin{pmatrix} x_0 \\ x_1 \end{pmatrix}$$

$$= \left(e^{-\frac{\mu J}{2}} e^{\mu J/2} \right.$$

$$e^{-\mu J}$$