Define the Standard 90deg Cell: $\mu := 90 \cdot deg$ $\nu := \frac{\mu \cdot 27}{2 \cdot \pi}$ $\nu = 6.75$

$F := 25$

$s := \sin(\mu)$ $c := \cos(\mu)$

$$\alpha := \sqrt{\frac{1 + \sin\left(\frac{\mu}{2}\right)}{1 - \sin\left(\frac{\mu}{2}\right)}}$$

$\beta_F := 2 \cdot F \cdot \alpha$ $\beta_D := 2 \cdot F \cdot \frac{1}{\alpha}$

$\gamma_F := \frac{1 + \alpha^2}{\beta_F}$ $\gamma_D := \frac{1 + \left(\frac{1}{\alpha}\right)^2}{\beta_D}$

$$M_0 := \begin{pmatrix} c + \alpha \cdot s & \beta_F \cdot s & 0 & 0 \\ -\gamma_F \cdot s & c - \alpha \cdot s & 0 & 0 \\ 0 & 0 & c - \frac{1}{\alpha} \cdot s & \beta_D \cdot s \\ 0 & 0 & -\gamma_D \cdot s & c + \frac{1}{\alpha} \cdot s \end{pmatrix}$$

$$M_0 = \begin{pmatrix} 2.414 & 120.711 & 0 & 0 \\ -0.057 & -2.414 & 0 & 0 \\ 0 & 0 & -0.414 & 20.711 \\ 0 & 0 & -0.057 & 0.414 \end{pmatrix}$$

Define the Skew Quad Matrices:

$k_1 := .02$ $k_2 := -.02$

$$M_{k1} := \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & k_1 & 0 \\ 0 & 0 & 1 & 0 \\ k_1 & 0 & 0 & 1 \end{pmatrix}$$

$$M_{k2} := \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & k_2 & 0 \\ 0 & 0 & 1 & 0 \\ k_2 & 0 & 0 & 1 \end{pmatrix}$$

Define the Initial Conditions:

$$X0_0 := \begin{pmatrix} 5 \\ 0 \\ 0 \\ 0 \end{pmatrix} \quad \begin{matrix} x \\ x' \\ y \\ y' \end{matrix} \qquad X1_0 := M_0^{\,5} \cdot M_{k1} \cdot X0_0 \qquad X2_0 := M_0^{\,5} \cdot M_{k2} \cdot M_0^{\,7} \cdot X1_0$$

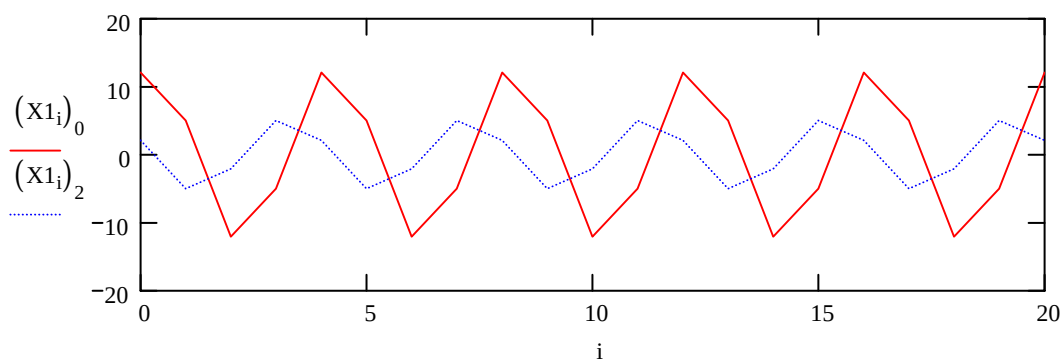
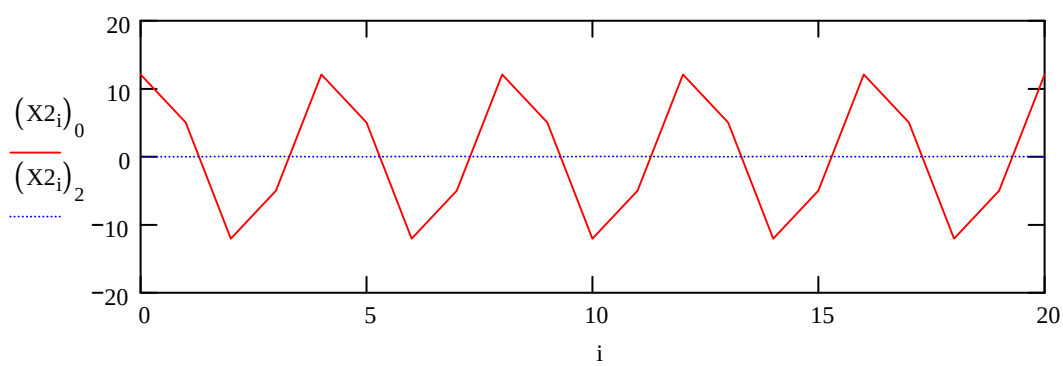
Number of turns to track: $i := 0 .. 20$

Iterate...

$$\begin{pmatrix} X0_{i+1} \\ X1_{i+1} \\ X2_{i+1} \end{pmatrix} := \begin{pmatrix} M_0^{\,15} \cdot M_{k2} \cdot M_0^{\,12} \cdot M_{k1} \cdot X0_i \\ M_0^{\,5} \cdot M_{k1} \cdot M_0^{\,15} \cdot M_{k2} \cdot M_0^{\,7} \cdot X1_i \\ M_0^{\,5} \cdot M_{k2} \cdot M_0^{\,12} \cdot M_{k1} \cdot M_0^{\,10} \cdot X2_i \end{pmatrix}$$

Results:

BPM 1: red (solid) = horizontal, blue (dash) = vertical



BPM 2: red (solid) = horizontal, blue (dash) = vertical