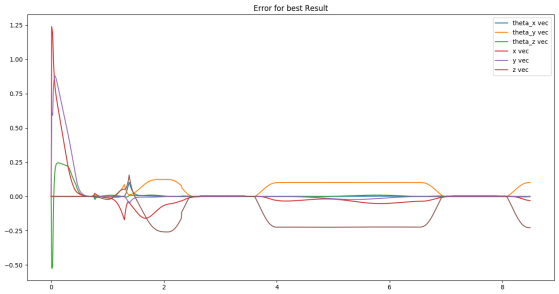

Figure 1: Error Dynamics of the Best Case

0.1 Best Result

This is a feedforward + PIcontroller, which solves the pick and place problem but cannot fully eliminate steady state errors as shown above. When K_i terms increase, the steady state errors are reduced but more oscillations will come in before they are fully eliminated.

The error dynamics is illustrated in Figure 1

$$K_p = \begin{bmatrix} 30.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 20.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 30.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 20.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 30.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 30.0 \end{bmatrix}$$

$$K_i = \begin{bmatrix} 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.1 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.1 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.1 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.1 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.2 \end{bmatrix}$$