Spm5 mm 9 MIMO deez nuts

a)

$$\begin{bmatrix} T_T(s) \\ T_B(s) \end{bmatrix} = \begin{bmatrix} h_{11}(s) & h_{12}(s) \\ h_{21}(s) & h_{22}(s) \end{bmatrix}$$

$h_{11}(s) = \frac{-10}{1+10s}$ $h_{12}(s) = \frac{3}{(1+10s)(1+8s)}$

$h_{21}(s) = \frac{-11}{1+20s}$ $h_{22}(s) = \frac{10}{1+10s}$

$R = P(0) .* (P(0)^{-1})^T$

Best pairing RGA

$P(0) = \begin{bmatrix} -10 & 3 \\ 11 & 10 \end{bmatrix}$, $(P(0)^{-1})^T = \begin{bmatrix} -0.15 & -0.16 \\ 0.045 & 0.15 \end{bmatrix}$

$R = \begin{bmatrix} 1.5 & -0.5 \\ -0.5 & 1.5 \end{bmatrix}$, $\lambda = \underline{\underline{1.5}}$

$\lambda > 1$ = Bad pairing

Decoupling Time!

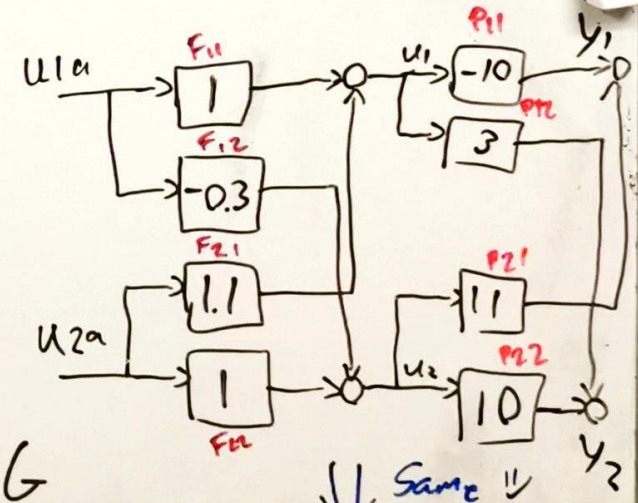
$$Q = \frac{P_{21} \cdot P_{12}}{P_{11} \cdot P_{22}} = \frac{11 \cdot 3}{-10 \cdot 10} = \frac{33}{-100} = -0.33$$

$F_{11} = F_{22} = 1$

$F_{12} = -F_{11} \frac{P_{12}}{P_{22}} \rightarrow -\frac{3}{10} = -0.3$

$F_{21} = -F_{22} \frac{P_{21}}{P_{11}} \rightarrow -\frac{11}{-10} = 1.1$

Use siso tool for siso controller



GG

Same

$\frac{y_1}{u_{1a}} = (1-(-0.33)) \cdot 1 \cdot (-10) = -13.33...$

$\frac{y_2}{u_{2a}} = (1-(-0.33)) \cdot 1 \cdot 10 = 13.33...$