

$$a_1 = \frac{J_2 - J_3}{J_1}, \quad a_3 = \frac{J_2 - J_1}{J_3}$$

$$T_1 = \frac{M_1 + u_1}{J_1} = (s^2 + n^2 a_1) \theta_1 + s n (a_1 - 1) \theta_3$$

$$T_3 = \frac{M_3 + u_3}{J_3} = s n (1 - a_3) \theta_1 + (s^2 + n^2 a_3) \theta_3$$

$$\theta_3 = \frac{T_3 - s n (1 - a_3) \theta_1}{s^2 + n^2 a_3}$$

$$T_1 = (s^2 + n^2 a_1) \theta_1 + s n (a_1 - 1) \left(\frac{T_3 - s n (1 - a_3) \theta_1}{s^2 + n^2 a_3} \right)$$

$$T_1 (s^2 + n^2 a_3) - T_3 s n (a_1 - 1) = \theta_1 \left[(s^2 + n^2 a_1)(s^2 + n^2 a_3) - s^2 n^2 (a_1 - 1)(1 - a_3) \right]$$

simplify to
 $D \rightarrow (s^2 + n^2)(s^2 + a_3 n^2)$

$$\theta_1 = \frac{(s^2 + n^2 a_3)}{D} T_1 + \frac{-s n (a_1 - 1)}{D} T_3$$

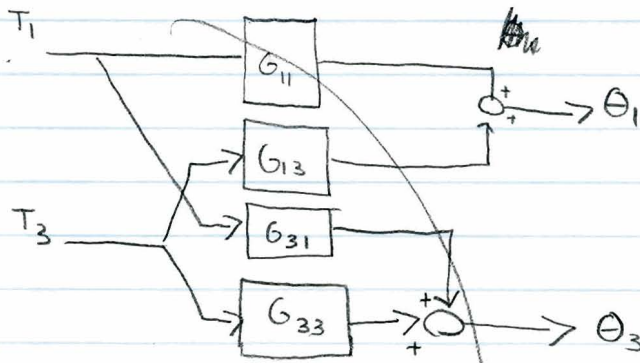
$$G_{11} = N_{11}/D$$

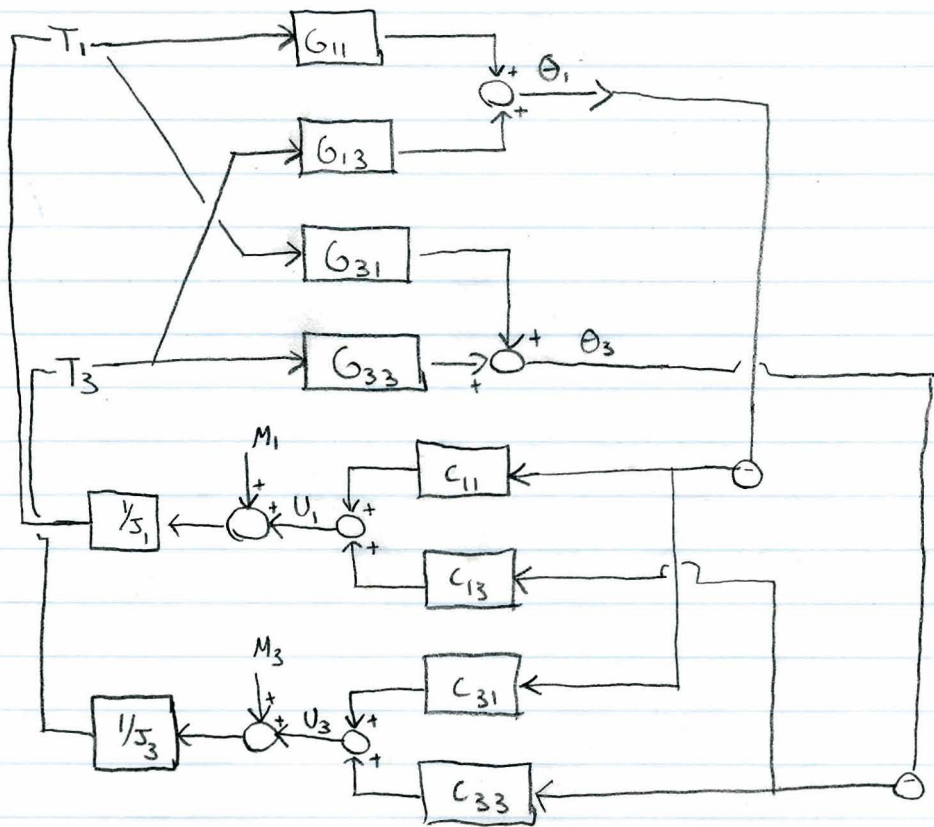
$$G_{13} = N_{13}/D$$

$$\theta_3 = \frac{-s n (1 - a_3)}{D} T_1 + \frac{(s^2 + n^2 a_1)}{D} T_3$$

$$G_{31} = N_{31}/D$$

$$G_{33} = N_{33}/D$$





Common step: kill controllers C_{13} & C_{31}

$$\begin{bmatrix} \theta_1 \\ \theta_3 \end{bmatrix} = \begin{bmatrix} G_{11} & G_{13} \\ G_{31} & G_{33} \end{bmatrix} \begin{bmatrix} T_1 \\ T_3 \end{bmatrix}$$

$$\begin{bmatrix} U_1 \\ U_2 \end{bmatrix} = \begin{bmatrix} C_{11} & C_{13}^0 \\ C_{31}^0 & C_{33} \end{bmatrix} \begin{bmatrix} \theta_1 \\ \theta_3 \end{bmatrix}$$

Now, Look at Input from θ_1 , & working with only 1 controller

4/15/08

