AE5222 Homework 6

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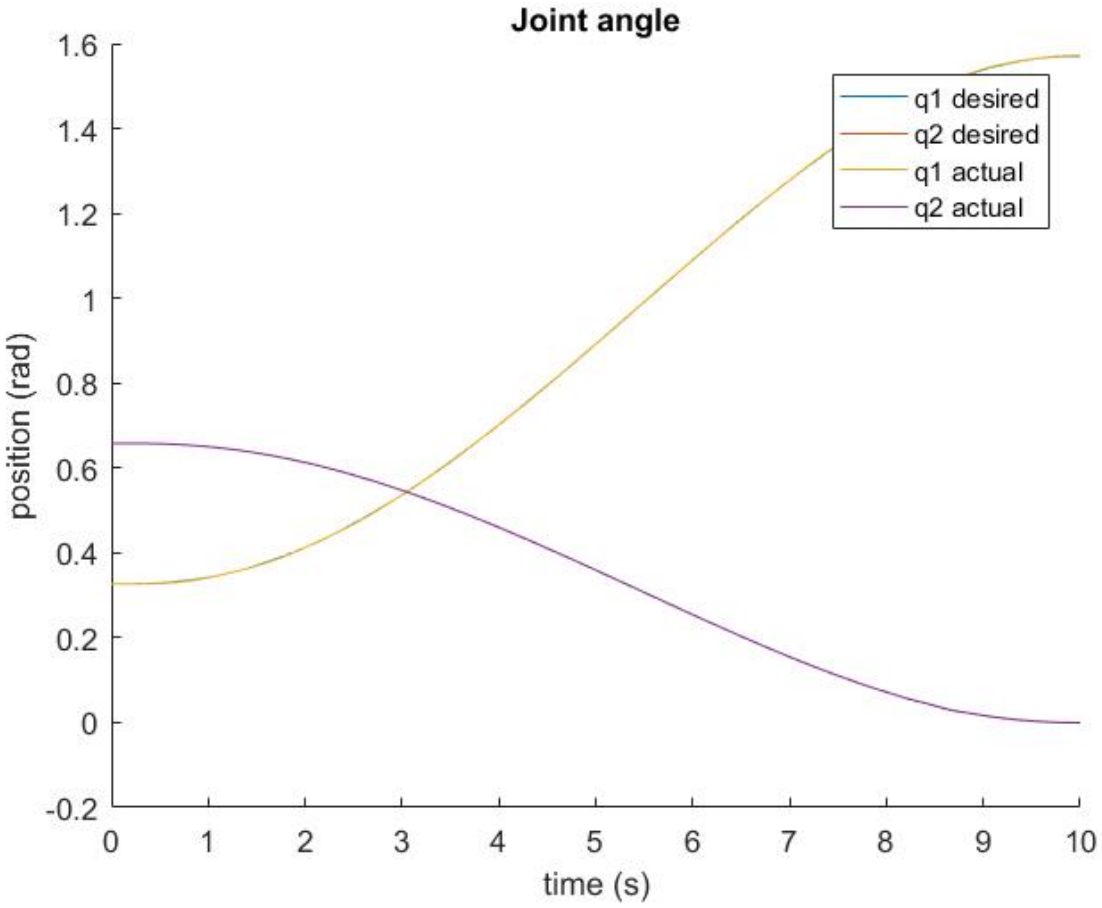
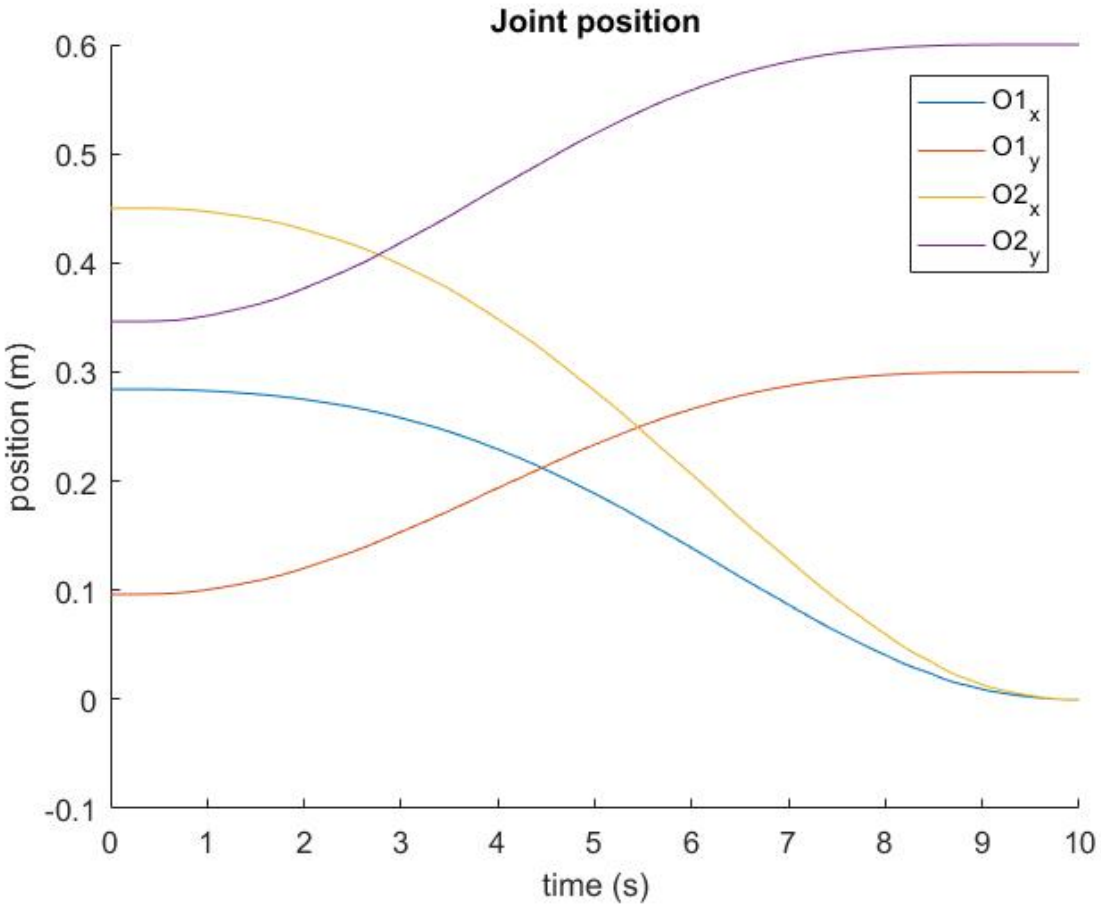
Problem 1

A feed froward controller was created in Matlab/Simulink. The model is attached. The arm was made to go from $[1.5000, 1.8660] \rightarrow [0, 2]$. The following graphs were produced.





Problem 2

$$V = 0.5r^T M(q)r + e^T \Lambda K e \tag{1}$$

$$\begin{aligned}
\dot{V} &\leq r^T M(q)r + 0.5r^T \dot{M} r + e^T \Lambda K \dot{e} \\
&\leq -r^T K r + 2e^T \Lambda K \dot{e} + 0.5r^T (\dot{M} - 2C)r \\
&\leq -e^T \Lambda [T] K e - \dot{e}^T K \dot{e} \\
&\leq -e^T Q e \geq 0
\end{aligned} \tag{2}$$

$$Q = \begin{bmatrix} \Lambda^T K \Lambda & 0 \\ 0 & K \end{bmatrix}$$

$$\lambda_{min}(Q) \left\| e \right\|^2 \leq e^T Q e \tag{3}$$

$$\left\| e \right\|^2 \leq (\lambda_{min}(Q)^{-1} e^T Q e)^{0.5} \tag{4}$$

As $e \to 0$ the system reaches asymptotic stability.