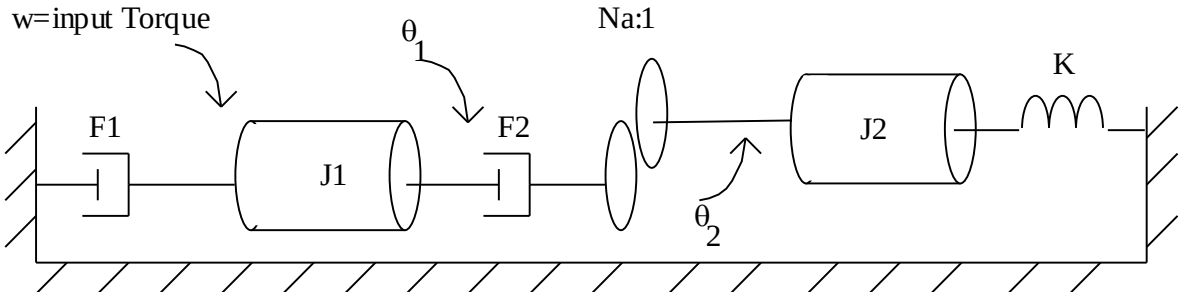
Due Wednesday, September 7 EE571 HW#3

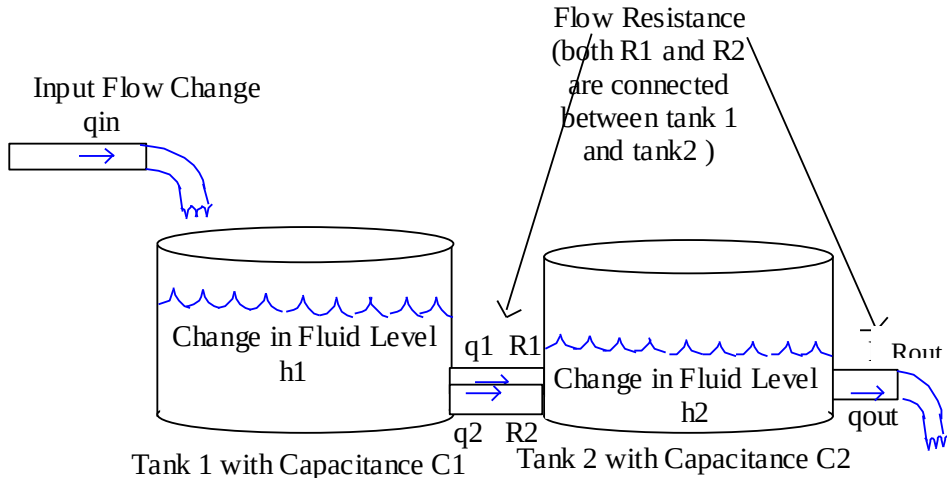
0. Pick a lab partner to work with. Your first lab is coming soon.

1. a) Find an analogous circuit then a state variable model for the rotational system shown below:



Let F1=F2=1 Nms/rad, K= 4 Nm/rad, J1= 1/3 Nms^2,J2= 1/2 Nms^2 and Na=2

b) Use the analogous circuit method to find the state variable model for the following fluid tank system (follow the example given in class):



2. a) DON"T DO PROBLEM 2 YET! Find eigenvalues and eigenvectors for

$$i)\ A=\begin{bmatrix}4 & 2\\ 2 & 4\end{bmatrix}\quad ii)\ A=\begin{bmatrix}-1 & 0 & 0\\ 0 & -3 & 0\\ 0 & 0 & 2\end{bmatrix}\quad iii)\ A=\begin{bmatrix}0 & 1\\ -5 & -2\end{bmatrix}$$

(hint: remember the determinant of a diagonal matrix is the product of the diagonal elements. Also, one or more of these matrices may have complex eigenvalues and eigenvectors!)

b) Find the state transition matrix, e^{At} , for the matrices in part a) (check your answers by putting in t=0 and seeing if you get the identity matrix back).

c) Again using the matrices in problem 2a), solve the homogeneous state variable model, $\dot{x} = Ax, \quad x(0)$ with the initial state, x(0) = $[2\ 5]^T$ (^{T} means take the transpose)