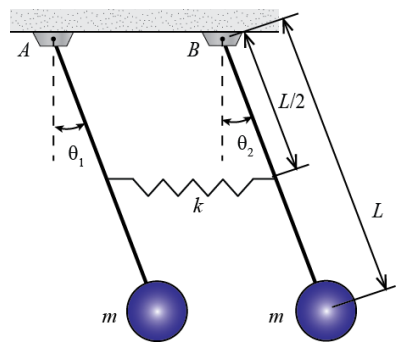
Quiz #2

ENGR 4220/5220: Control Systems

Professor Hill

University of Detroit Mercy, Summer 2013

Consider the system shown below and its associated linearized equations of motion where $M(t)$ is an external moment applied to the left pendulum (not shown).



$$J\ddot{\theta}_1(t) + mgL\theta_1(t) + k\frac{L^2}{4}(\theta_1(t) - \theta_2(t) = M(t)$$
$$J\ddot{\theta}_2(t) + mgL\theta_2(t) + k\frac{L^2}{4}(\theta_2(t) - \theta_1(t)) = 0$$

1. (3 point) Find a minimum number of state variables that are needed to capture the state of the given system. Explain how you chose this set.

2. (7 points) Convert the given equations of motion into its state space matrix form. You may take that $M(t)$ to be the system's input and $\dot{\theta}_2(t)$ to be the system's output.