

4) In order to adapt for a compound pendulum, we must use the length from the pivot point to the Center of Gravity instead of just the length from the mass to the pivot point. We must use the second order equation for the compound pendulum below:

$$\ddot{\theta} + \frac{mgl_c}{J_0} \sin\theta = 0$$

As a result, the values \dot{x}_2 and \dot{x}_1 will become twice their original value. x_2 and \dot{x}_1 both equal angular velocity. See below for equations for \dot{x}_1 and \dot{x}_2 :

$$J\ddot{\theta} + b\dot{\theta} + mgl \sin\theta = 0$$

$$x_1 = \theta, \quad \dot{x}_1 = \dot{\theta} = x_2$$

$$x_2 = \dot{\theta}, \quad \dot{x}_2 = \ddot{\theta}$$

$$\hookrightarrow \dot{x}_2 = \frac{1}{J} [-b\dot{\theta} - mgl \sin\theta]$$

$$\hookrightarrow \dot{x}_2 = \frac{1}{J} [-bx_2 - mgl \sin x_1]$$