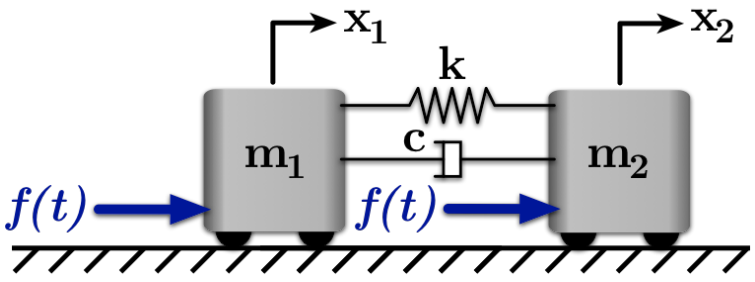
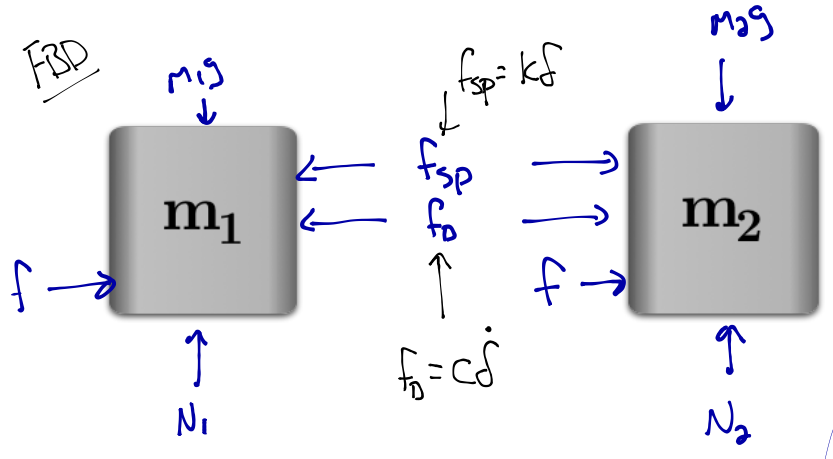
MCHE485 Live Session - 04/28/2020





$f = 0$

$$T = \frac{1}{2} m_1 \dot{x}_1^2 + \frac{1}{2} m_2 \dot{x}_2^2$$

$$V = \frac{1}{2} k \delta^2 \rightarrow \frac{1}{2} k (x_1 - x_2)^2$$

$$RD = \frac{1}{2} c \dot{\delta}^2 \rightarrow \frac{1}{2} c (\dot{x}_1 - \dot{x}_2)^2$$

δ = displacement of spring from eq

$$L = T - V = \left[\frac{1}{2} m_1 \dot{x}_1^2 + \frac{1}{2} m_2 \dot{x}_2^2 \right] - \frac{1}{2} k (x_1 - x_2)^2$$

$$\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{q}_i}\right) + \frac{\partial RD}{\partial \dot{q}_i} - \frac{\partial L}{\partial q_i} = Q_i$$

Q_i = generalized force

$\bar{q} = [x_1, x_2]$

$$\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{x}_1}\right) + \frac{\partial RD}{\partial \dot{x}_1} - \frac{\partial L}{\partial x_1} = 0$$

$$\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{x}_2}\right) + \frac{\partial RD}{\partial \dot{x}_2} - \frac{\partial L}{\partial x_2} = 0$$

$$L = \left[\frac{1}{2} m_1 \dot{x}_1^2 + \frac{1}{2} m_2 \dot{x}_2^2 \right] - \frac{1}{2} k (x_1 - x_2)^2$$

for x_1

$$\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{x}_1}\right) + \frac{\partial RD}{\partial \dot{x}_1} - \frac{\partial L}{\partial x_1} = 0$$

$$\frac{\partial L}{\partial \dot{x}_1} = m_1 \dot{x}_1 \qquad \frac{\partial RD}{\partial \dot{x}_1} = c(\dot{x}_1 - \dot{x}_2) \qquad \frac{\partial L}{\partial x_1} = -k(x_1 - x_2)$$

$$\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{x}_1}\right) = m_1 \ddot{x}_1$$

$$\boxed{m_1 \ddot{x}_1 + c(\dot{x}_1 - \dot{x}_2) + k(x_1 - x_2) = 0}$$

for x_2

$$\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{x}_2}\right) + \frac{\partial RD}{\partial \dot{x}_2} - \frac{\partial L}{\partial x_2} = 0$$

$$\frac{\partial L}{\partial \dot{x}_2} = m_2 \dot{x}_2 \qquad \frac{\partial RD}{\partial \dot{x}_2} = c(-1)(\dot{x}_1 - \dot{x}_2) \qquad \frac{\partial L}{\partial x_2} = k(x_1 - x_2)$$

$$\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{x}_2}\right) = m_2 \ddot{x}_2$$

$$\boxed{m_2 \ddot{x}_2 - c(\dot{x}_1 - \dot{x}_2) - k(x_1 - x_2) = 0}$$