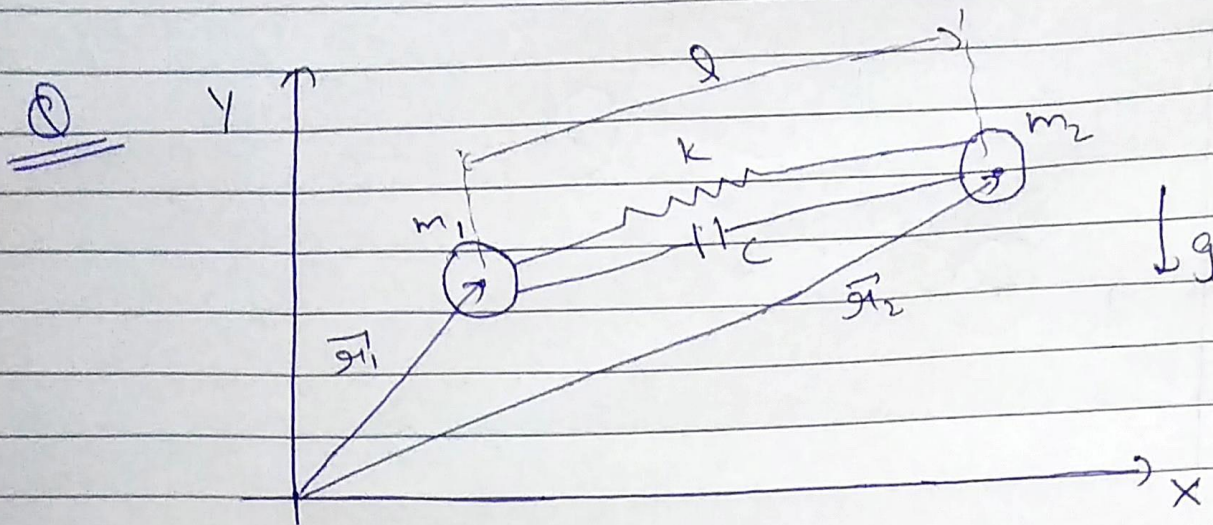


ME 3030 Assignment - 1



Spring force

$$\vec{F}_s = k \left(|\vec{r}_2 - \vec{r}_1| - l \right) \left(\frac{\vec{r}_2 - \vec{r}_1}{|\vec{r}_2 - \vec{r}_1|} \right)$$

Damping force

$$\vec{F}_d = c(\dot{\vec{r}}_2 - \dot{\vec{r}}_1)$$

Gravity force

$$\vec{F}_g = -m\vec{g}$$

$$\vec{r}_1 = \begin{Bmatrix} x_1(t) \\ y_1(t) \end{Bmatrix} \quad \vec{r}_2 = \begin{Bmatrix} x_2(t) \\ y_2(t) \end{Bmatrix} \quad \dot{\vec{r}}_1 = \begin{Bmatrix} \dot{x}_1(t) \\ \dot{y}_1(t) \end{Bmatrix}$$

$$\dot{\vec{r}}_2 = \begin{Bmatrix} \dot{x}_2(t) \\ \dot{y}_2(t) \end{Bmatrix}$$

Writing equations for m_1 :

$$m_1 \begin{Bmatrix} \ddot{x}_1(t) \\ \ddot{y}_1(t) \end{Bmatrix} = k \left(\frac{|\vec{r}_2 - \vec{r}_1| - l}{|\vec{r}_2 - \vec{r}_1|} \right) \begin{Bmatrix} x_2 - x_1 \\ y_2 - y_1 \end{Bmatrix} + c \begin{Bmatrix} \dot{x}_2 - \dot{x}_1 \\ \dot{y}_2 - \dot{y}_1 \end{Bmatrix} - m_1 \begin{Bmatrix} 0 \\ g \end{Bmatrix}$$

Writing equations for m_2 :

$$m_2 \begin{Bmatrix} \ddot{x}_2(t) \\ \ddot{y}_2(t) \end{Bmatrix} = k \left(\frac{|\vec{r}_2 - \vec{r}_1| - l}{|\vec{r}_2 - \vec{r}_1|} \right) \begin{Bmatrix} x_1 - x_2 \\ y_1 - y_2 \end{Bmatrix} - c \begin{Bmatrix} \dot{x}_2 - \dot{x}_1 \\ \dot{y}_2 - \dot{y}_1 \end{Bmatrix} - m_2 \begin{Bmatrix} 0 \\ g \end{Bmatrix}$$