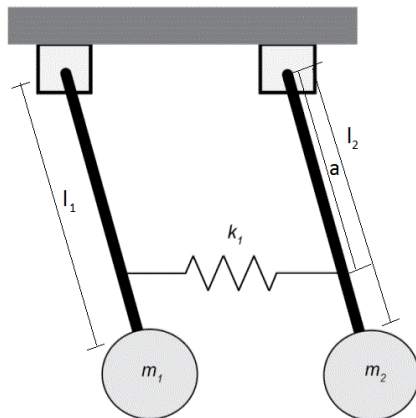


MEL3020: Kinematics and Dynamics of Machines (Practical Sessions)

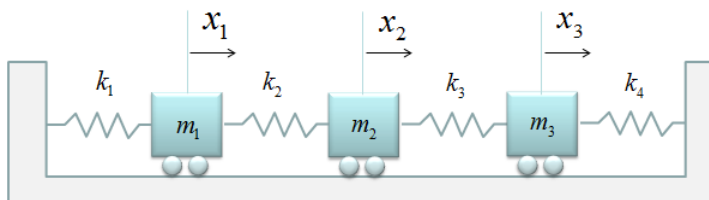
Session: 9

1. Simulate a double pendulum spring system with the following equations using Octave or MATLAB. $L_1=1\text{m}$, $l_2=1.2\text{m}$, $a=1\text{m}$, $m_1=1.5\text{kg}$, $m_2=1.1\text{kg}$, $k_1=4\text{N/m}$



$$\begin{bmatrix} m_1 l_1^2 & 0 \\ 0 & m_2 l_2^2 \end{bmatrix} \begin{Bmatrix} \ddot{\theta}_1 \\ \ddot{\theta}_2 \end{Bmatrix} + \begin{bmatrix} (k_1 a^2 + m_1 g l_1) & -k_1 a^2 \\ -k_1 a^2 & (k_1 a + m_2 g l_2) \end{bmatrix} \begin{Bmatrix} \theta_1 \\ \theta_2 \end{Bmatrix} = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$$

2. Simulate the following spring mass system in MATLAB or Octave. $M_1=1\text{kg}$, $m_2=2\text{kg}$, $m_3=3\text{kg}$, $k_1=3\text{N/m}$, $k_2=1.5\text{N/m}$, $k_3=2\text{N/m}$, $k_4=1\text{N/m}$, $l_1=1.5\text{m}$, $l_2=1.2\text{m}$, $l_3=1.1\text{m}$, $l_4=1.8\text{m}$.
Initial $x_1=0.1\text{m}$, $x_2=-0.1$ and $x_3=0.2\text{m}$



$$\begin{bmatrix} m_1 & 0 & 0 \\ 0 & m_2 & 0 \\ 0 & 0 & m_3 \end{bmatrix} \begin{Bmatrix} \ddot{x}_1 \\ \ddot{x}_2 \\ \ddot{x}_3 \end{Bmatrix} + \begin{bmatrix} (k_1 + k_2) & -k_2 & 0 \\ -k_2 & (k_2 + k_3) & -k_3 \\ 0 & -k_3 & (k_3 + k_4) \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \\ x_3 \end{Bmatrix} = \begin{Bmatrix} 0 \\ 0 \\ 0 \end{Bmatrix}$$

