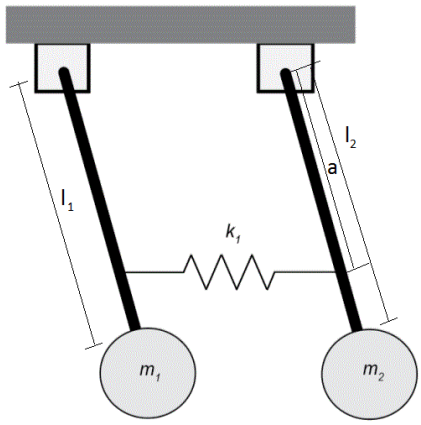
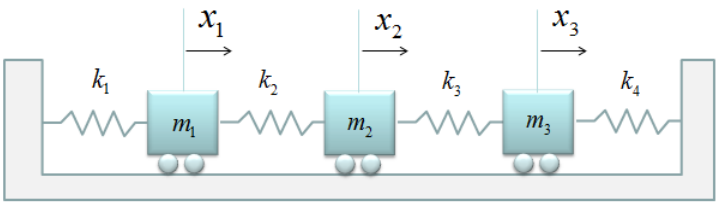
MEL3020: Kinematics and Dynamics of Machines (Practical Sessions)
Session: 9

1. Simulate a double pendulum spring system with the following equations using Octave or MATLAB. L1=1m, l2=1.2m, a=1m, m1=1.5kg, m2=1.1 kg, k1=4N/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. M1=1kg, m2=2kg, m3=3kg, k1=3N/m, k2=1.5N/m, k3=2N/m, k4=1N/m, l1=1.5m, l2=1.2m, l3=1.1m, l4=1.8m. Initial x1=0.1m, x2= -0.1 and x3= 0.2m



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