Wentworth Institute of Technology
Electromechanical Engineering Program

ELMC815 Electromechanical Systems I
Laboratory Exercise #8
(Formal report)

Objective: To solve multi-degree of freedom problems both analytically and by simulation.

Procedure:

For $m_1=m_2=1$ kg and k= 4 N/m, in the following problem:

a) Write the differential equations that describe the system.
-Determine the natural frequencies
-Determine the corresponding mode shapes.
-**Analytically** determine the response: $x_1(t)$ *and* $x_2(t)$ for initial conditions:

$$x_1(0)=2 \quad x_2(0)=4 \quad \dot{x}_1(0)=0 \quad \dot{x}_2(0)=0$$

b) Integrate the system of equations by Laplace transforms:
Solve the system for $X_1(s)$, $X_2(s)$.
-b1) Use **Partial Fraction** decomposition to determine the response: $x_1(t)$ *and* $x_2(t)$
- b2) Use the **Matlab** function *ilaplace or Dsolve* to find $x_1(t)$ *and* $x_2(t)$ from $X_1(s)$ and $X_2(s)$

c) Write the differential equations from a) in **State-Space** form, determine the matrices A, B, C, D
-Simulate the problem by **Simulink** (use **State Space Toolbox** and insert elements from matrices A, B, C, D)

d) Simulate the problem by **Working Model**

e) Compare the analytical results with the simulated results.

Use Excel to write equation from a) and create a graph with multiple data from b), c), and d), to be compared.

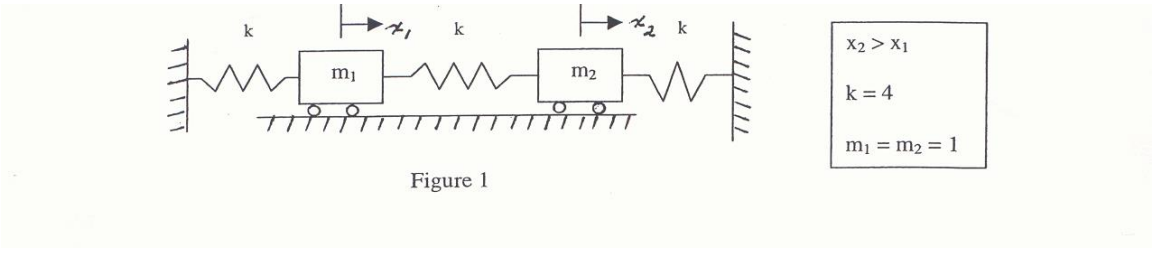

Figure 1

Conclusions: