
Vibrations and Dynamics - 2

Solve the following problem and show all work.

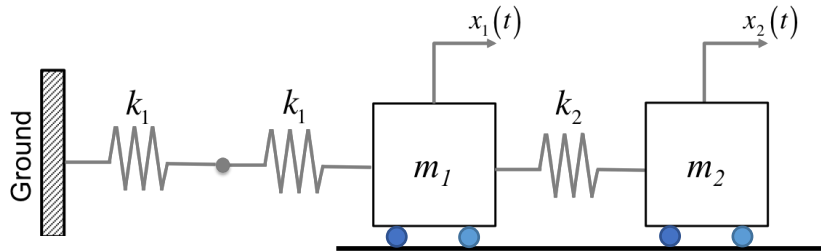


Figure 1. Two degree of freedom schematic.

Given the system in [Figure 1](#) perform the following:

- 1) Show the free body diagram (FBD) marking all forces **(15 points)**
- 2) Derive the equations of motion then place them in matrix form **(25 points)**
- 3) Obtain the natural frequencies and mode shapes if the system has the following characteristics: **(25points)**
 - a. $m_1 = 9 \text{ kg}$, $m_2 = 1 \text{ kg}$, $k_1 = 48 \text{ N/m}$, and $k_2 = 3 \text{ N/m}$
- 4) Sketch the mode shapes relative to their static position of each mass in [Figure 1](#). **(20 points)**
- 5) What driving frequency is required to have the system experience resonance? **(15 points)**