All Assignments

Use MATLAB wherever possible to work the problem or check your work on a problem. ***Whenever a requested problem asks you to plot or sketch the answer, you must use MATLAB to do your work***.

Treat the homework like a quiz! In other words, don't do the homework with the notes open. Instead, study and learn the material as well as you can, and then try to work the homework problems. If you get stuck, cover up the homework, re-read the notes, and try again.

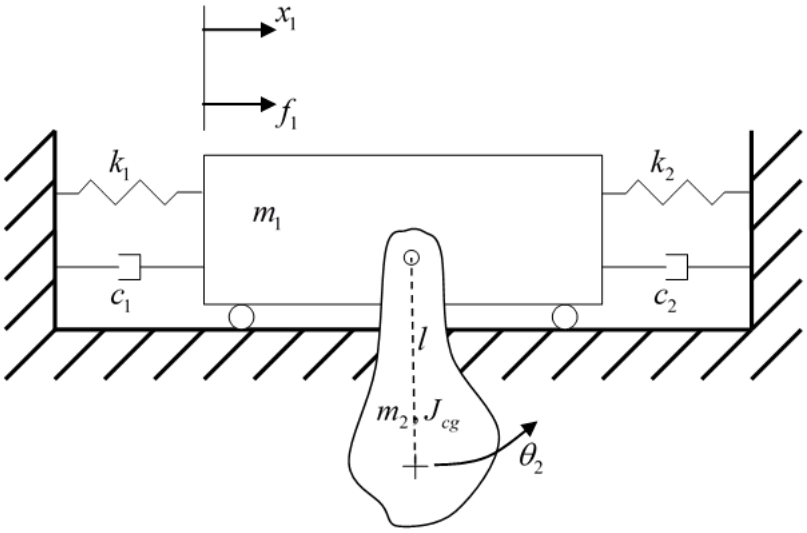
If you work homework as a group, you **must** identify the group[*].

Assignment-9

- Reading
  - Handout sections #4, #7, #11 & #12
- Homework

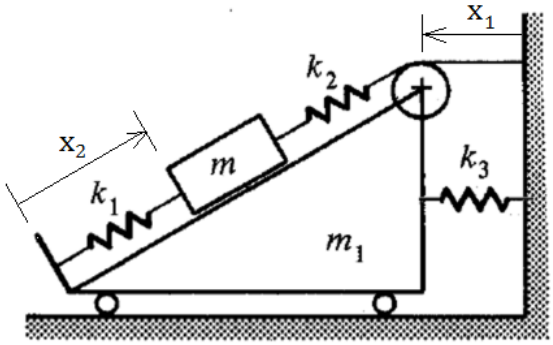
  For each of the following figures, develop the exact and linearized equations of motion by both Newton's Method and Lagrange's Method. Express the linearized equations of motion in matrix form.

  - **9-A)**



[*] *Remember that failure to provide proper reference/citation is called* ***plagiarism.***

- **9-B)** *Note: the pulley is massless; x_1 is absolute (from wall); x_2 is relative (to end of cart.)*
  α - angle between the incline and the horizontal



Each of the following problems will involve downloading a MATLAB data file. The variables are:

- t time (sec) : real vector
- x free decay response (m) : real vector
- f frequency (Hz) : real vector
- H frequency response functions (m/N) : complex matrix
  - Note: The frequency response functions are stored as H(p,q,s)
    - p is the output (response)
    - q is the input (force)
    - s is the spectral line (frequency)

- **9-C)** Plot the free decay response (x vs. t), with proper annotation. Estimate the log decrement (δ), damping factor (ζ), damped natural frequency (ω_r), and natural frequency (Ω_r). Identify on the plot the points you choose to use and your estimate of their values. (For the free decay plot, see notes section #4 for example.)

- **9-D)** Plot the frequency response functions (H vs. f), with proper annotation. Estimate the natural frequencies (Ω_r), damping factors (ζ_r), and mode shapes ($\{\psi\}_r$). Identify on the plot the points you choose to use and your estimate of their values. (For the FRF plots, plot both magnitude/phase and real/imaginary as in HW 6-D. See notes section #12 for examples.)

- Comments
  - The following MATLAB commands may be helpful.
    - load hwk9
    - H = squeeze(H); % Remove singleton dimension (q=1)
    - plot(t,x)
    - semilogy(f,abs(H))
    - plot(f,angle(H))
    - plot(f,real(H))
    - plot(f,imag(H))