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-6

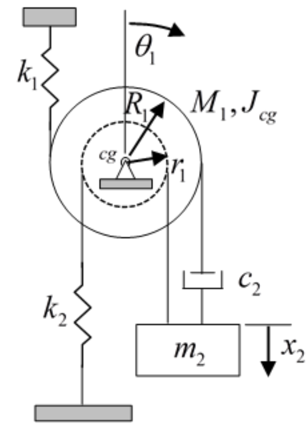
- Reading - Lecture Notes
  - Sections #6 & #7
- Homework
  - **6-A)** A machine part of mass 2.4 lb_m vibrates in a viscous medium.
    a) Determine the stiffness and the damping coefficients when a harmonic exciting force of 34 lb_f results in a resonant amplitude of 0.37 in. with a period of 0.15 s.
    b) If the system is excited by a harmonic force of frequency 6.0 Hz, what will be the percentage increase in the amplitude of forced vibration when the damper is removed? (▶*Note that the comparison is done at one frequency (6.0 Hz) with and without the damper.)*
  - **6-B)** A weight attached to a spring of stiffness 1552 N/m has a viscous damping device. When the weight is displaced and released, the period of vibration is 1.52 s, and the ratio of consecutive amplitudes is 2.8 to 1.0. Determine the amplitude and phase of the response when a force $F = 4.5\cos(4.23t)$ acts on the system.
  - **6-C)** A spring-mass is excited by an unspecified force $f(t) = F_0 \sin \omega t$. At resonance, the amplitude is measured to be 3.16 cm. At 0.85 resonant frequency, the amplitude is measured to be 1.5 cm. Determine the damping factor ζ of the system.
  - **6-D)** Using MATLAB, plot the single degree-of-freedom frequency response function (both magnitude/phase and real/imaginary format),

$$H(\omega) = \frac{1}{-m\omega^2 + j\omega c + k}$$

    Use the nominal values; m = 20 *kg*, c = 28 *N.s/m* & k = 5000*N/m*. Then let each vary $\pm 50\%$ in 10% increments. Discuss the results (e.g. magnitude, phase, resonance location, etc.). (You should have three different plots, one for each varying parameter [overlaid].) Present your results (magnitude/phase and real/imaginary) vs. frequency in Hertz. Label, title, and annotate, etc. each plot appropriately. (Don't forget UNITS! mag/real/imag in appropriate units; phase in degrees) Choose a reasonable frequency range and number of frequency values to plot to create an attractive (smooth) set of curves. (The MATLAB commands 'subplot // semilogy(f,abs(H)) // plot(f,angle(H)) // plot(f,real(H)) // plot(f,imag(H))' may be helpful. Use MATLAB programming style, NOT C/FORTRAN. Specifically, use vectorized notation.) Turn in a copy of your program with the output and discussion.

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

Solve following problem by both Newton's Method and Lagrange's Method. [Be careful about the kinematics.]



- **6-E)** Using Newton's Method, and the given set of coordinates, draw the complete two-sided free body diagram, identify any constraint equations, and determine the equations of motion for the adjacent figure in terms of the given coordinate θ_1.

- **6-F)** Using Lagrange's Method, and the given set of coordinates, identify any constraint equations, and determine the equations of motion for the adjacent figure in terms of the given coordinate θ_1.