GROUP MEMBERS:

CE 8060 – STRUCTURAL DYNAMICS
Homework #7

Assigned: Tuesday, September 9, 2014
Due: Thursday, September 11, 2014 (beginning of class)

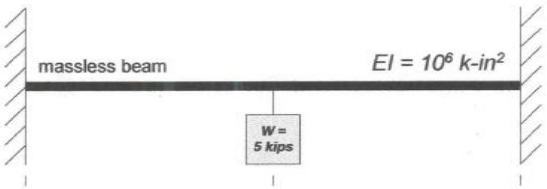
Homework must be done neatly in pencil, on 8 ½"x 11" paper, stapled together. Each step must be easily followed; diagrams are useful. Your assumptions must be clearly stated.

Make Sure to Include The Cover Page!

Make Sure to Write Both Group Members' Names!

Problem1: (5 points)

Consider a heavy mass of weight *W* mounted on the middle of the following beam system:



Assume the damping ratio of the beam is $\xi = 10\%$. The total length of the beam is 10 ft. (5 ft. on each side). If displacement, *u*, corresponds to the displacement of beam at the location of the attached weight, and if the system is given an initial displacement of 0.5 in and an initial velocity of 30 in/sec determine the following (*Write down your final solution in the following table*):

		solution
a	Write the equation of motion of the system - what type of system is it (i.e., underdamped, critically damped, overdamped)?	
b	The undamped natural frequency, ω_n and period, T_n of the system	
c	The damped natural frequency, ω_d and period, T_d of the system	
d	The critical damping coefficient, c_{cr}	
e	Phase angle of the vibrating motion, θ	
f	The peak displacement at time $t = T_d + \theta / \omega_d$	

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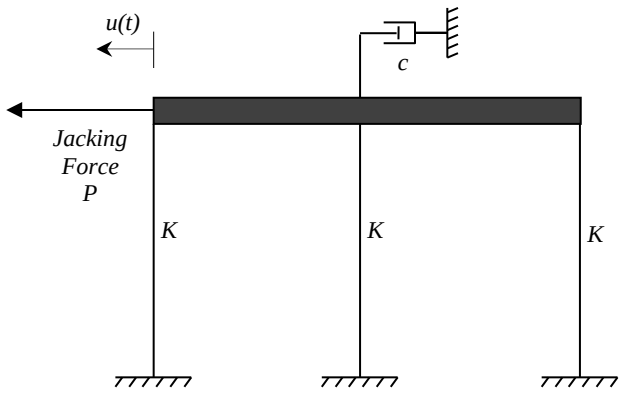
g	The peak displacement at time $t = 2T_d + \theta / \omega_d$	
h	The log-decrement, δ	

Problem2: (5 points)

Using a hydraulic jack, you supplied a jacking force to displace the frame. With a jacking force of 40 kips you note the frame has displaced 0.2 in. After jacking the frame, you release the frame from the jack and you record its motion. On the first return swing after release, the frame does not come back to the release point but rather only 0.16 in towards it. You recorded the time between the time of release, and the first return of 0.16 in - this time is 1.4 seconds.



Determine the following (*Write down your final solution in the following table*):

		solution
a	Natural frequency, ω_n	
b	Mass of the girder, m	
c	Log-decrement, δ	
d	Damping ratio, ξ	
e	Damping coefficient, c	
f	Damped natural frequency, ω_d	

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g	Amplitude of the frame after 4 cycles	
h	Plot time history response of the system	In a separate sheet

Reading material references: reading material #4 on Blackboard