CE 8060 – STRUCTURAL DYNAMICS
Homework #14

Assigned: Tuesday, October 7, 2014
Due: Friday, October 10, 2014 (Dr. Atam's mailbox at 4:00 pm.)

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 Write Both Group Members' Names!

The single bay/single story moment frame below with floor weight of 400 kips above is subject to harmonic ground motion ($u_g(t) = 10in \cdot \sin\Omega t \quad 0 < t < 10T \quad T = \dfrac{2\pi}{\Omega}$) whose frequency Ω is twice that of the natural frequency ω_n.

Determine the constants A_1, B_1, C and D in the expressions below for the displacement of the floor relative to the moving ground for 10 cycles of ground motion

$$u(t) = e^{-\zeta\omega_n t} \cdot (A_1 \cos\omega_D t + B_1 \sin\omega_D t) + C\sin\Omega t + D\cos\Omega t \qquad 0 < t < 10T \qquad T = \frac{2\pi}{\Omega}$$

After 10 cycles the ground motions stops and the structure vibrates freely. Determine the constants A_2, B_2 in the expression below for 2 seconds of free vibration after the ground has stopped moving.

$$u(t_1 + 10T) = e^{-\zeta\omega_n t_1} \cdot (A_2 \cos\omega_D t_1 + B_2 \sin\omega_D t_1) \quad 0 < t_1 < 2\sec$$

Plot $u(t)$ and $u_g(t)$ as a function of time.