

EM 633  
H.W. #9

1.

A cantilever beam supporting three equal lumped masses is shown in Fig. P12-1; also listed there are its undamped mode shapes  $\Phi$  and frequencies of vibration  $\omega$ . Write an expression for the dynamic response of mass 3 of this system after an 8-kips step function load is applied at mass 2 (i.e., 8 kips is suddenly applied at time  $t = 0$  and remains on the structure permanently), including all three modes and neglecting damping. Plot the history of response  $v_3(t)$  for the time interval  $0 < t < T_1$  where  $T_1 = 2\pi/\omega_1 = 2\pi/3.61$ .

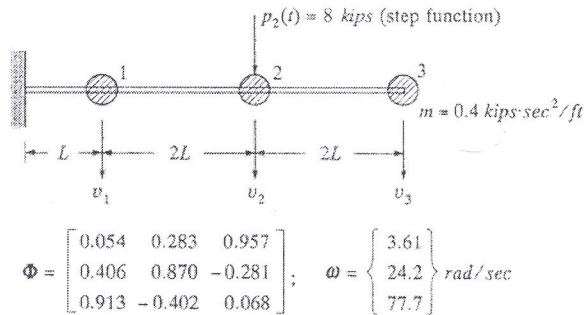


FIGURE P12-1

2.

The mass and stiffness properties of a three-story shear building, together with its undamped vibration mode shapes and frequencies, are shown in Fig. P12-2. The structure is set into free vibration by displacing the floors as follows:  $v_1 = 0.3 \text{ in}$ ,  $v_2 = -0.8 \text{ in}$ , and  $v_3 = 0.3 \text{ in}$ , and then releasing them suddenly at time  $t = 0$ . Determine the displaced shape at time  $t = 2\pi/\omega_1$ .

below.

- (a) Assuming no damping.  
(b) Assuming  $\xi = 10\%$  in each mode.

