ADVANCED DYNAMICS OF STRUCTURES / HOMEWORK / October 22, 2003

a. Obtain the free vibration period of the single-degree-of-freedom system shown in the figure. *W = mg = 100kN* *k = 600kN/m* $\xi = 0.05$

b. Evaluate the displacement history of the system to the loading history given by using step by step numerical integration of the Duhamel integral for $0 \leq t \leq t_1$ by using Simpson rule under the assumption of the homogeneous initial conditions $v(t=0)=0$ $\dot{v}(t=0)=0$.

$t_o = 0.08s$ $t_1 = 0.80s$ $\Delta\tau = 0.01s$

$$v(t) = \frac{1}{m\,\omega_D}\int_o^t exp\left[-\xi\omega(t-\tau)\right]p(\tau)\sin\omega_D(t-\tau)\,d\tau \qquad 0 \leq t \leq t_o$$

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t (s)	*p(kN)*
0	0
0.01	133
0.02	213
0.03	240
0.04	213
0.05	133
0.08	0
0.10	0
0.20	0
0.40	0
0.80	0

c. Obtain the response of the system under the assumption that the external force can be represented as a impulse loading. Draw the variation of *v(t)* for the two last cases.

$$v(t) = \frac{I}{m\,\omega_D}exp\left[-\xi\,\omega\,t\right]\sin\omega_D t$$

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