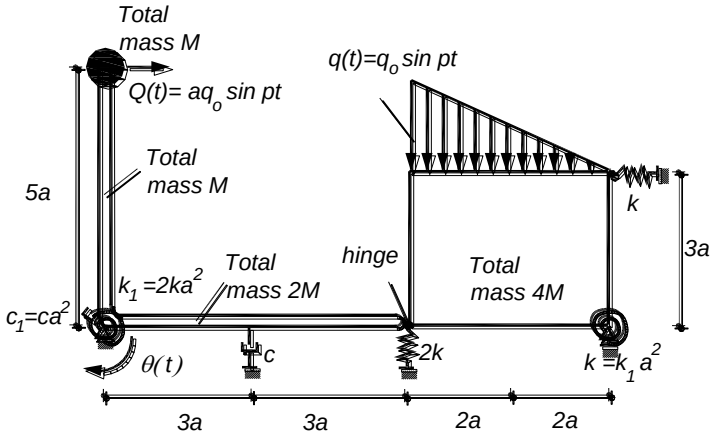
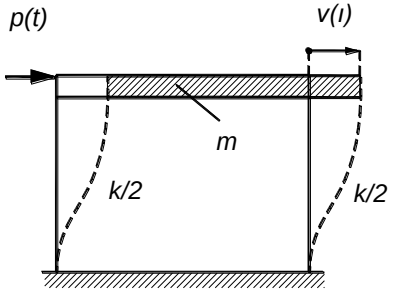
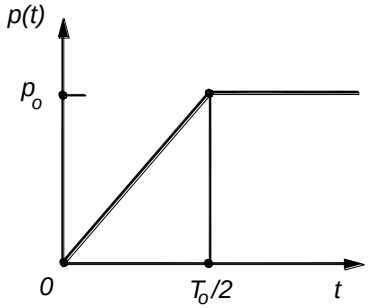
ADVANCED DYNAMICS OF STRUCTURES / HOMEWORK / October 28, 2009

1. Write down the equation of motion of the rigid-body assemblage in terms of $\theta(t)$ the rotation angle of the support by using the principle of the virtual work. Obtain the free vibration period $T = \alpha\sqrt{M/k}$ of the assemblage without considering the damping and determine α. Find the resonance condition in terms of the parameters of the system, when the damping is neglected.



2. A single degree of system of the mass m, the stiffness k is subjected to the external load $p(t)$. The variation of the external load is given as shown. Assuming the system starts from the rest position, i.e., $v(t=0)=0$ and $\dot{v}(t=0)=0$. Find the displacement function $v(0 \le t \le 0.5\,T_o)$ by using the initial conditions and $v(t \ge 0.5\,T_o)$ by using the continuity of the displacement and the velocity at $t = 0.5\,T_o$, where T_o. is the free vibration period of the system. Draw the displacement variation $v(t)/v_{static}$ where $v_{static} = p_o / k$.





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3. The single-degree-of-freedom system shown is subjected to an external load of impulse characters by assuming that the system starts from the rest, i.e., $v(t=0)=\dot{v}(t=0)=0$ $M_o\,\ddot{v} + K_o\,v = Q(t)$. Find out the displacement $v(t)$, the velocity $\dot{v}(t)$ and the acceleration $\ddot{v}(t)$. Obtain the maximum shear force and bending moment. $M_o g = 100kN$, $K_o = 600kN/m$, $Q_o = 40kN$; $h = 10m$