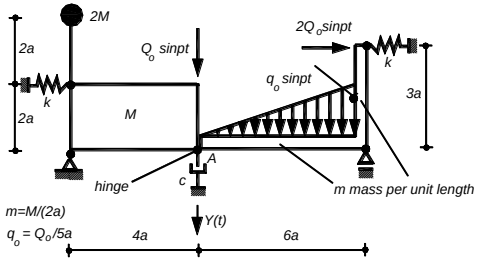
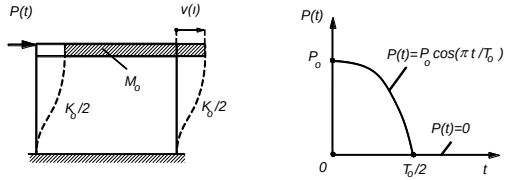
ADVANCED DYNAMICS OF STRUCTURES / HOMEWORK # 1 October 20, 2010

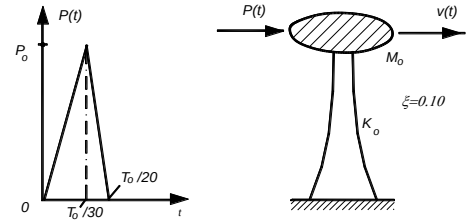
1. Write down the equation of motion of the rigid-body assemblage in terms of $\theta(t)$ the rotation angle of the support A by using the principle of the virtual work. Obtain the free vibration period $T = \alpha\sqrt{M/k}$ of the assemblage without considering the damping and determine α. Find the 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_o, the stiffness K_o is subjected to the external load $P_o(t)$. 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 $v(0 \le t \le T_o/2)$ by using the initial conditions and $v(t \ge T_o/2)$ by using the continuity of the displacement and the velocity at $t = T_o/2$, where T_o is the free vibration period of the system. Draw the displacement variation $v(t)/v_{statik}$ where $v_{statik} = P_o / K_o$.



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., $v(t=0)=0$ and $\dot{v}(t=0)=0$ $M_o\,\ddot{v}(t)+C_o\,\dot{v}(t)+K_o\,v(t)=P(t)$. 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, where T_o is the free undamped vibration period of the system.. $M_o\,g = 140kN$, $K_o = 800kN/m$, $\xi = 0.10$, $P_o = 50kN$, $h = 8.0m$.



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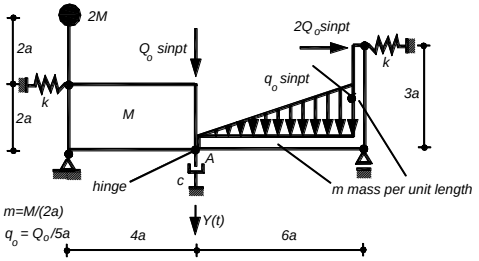

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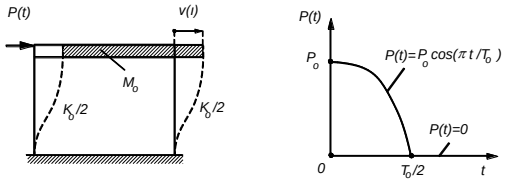

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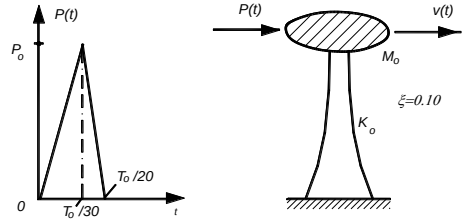

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