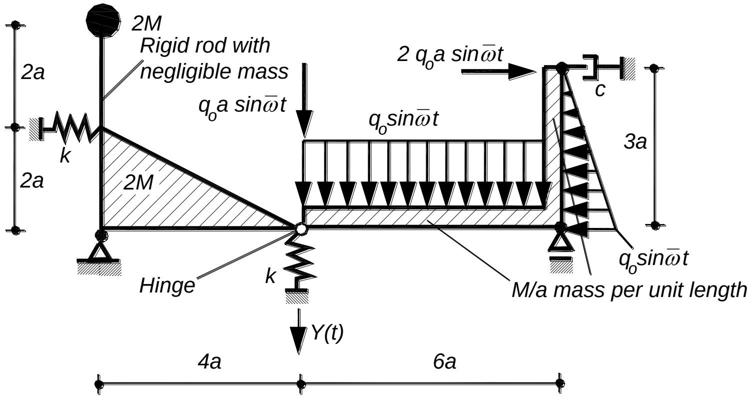
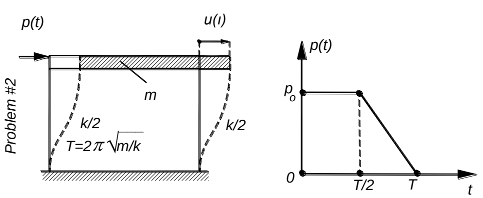
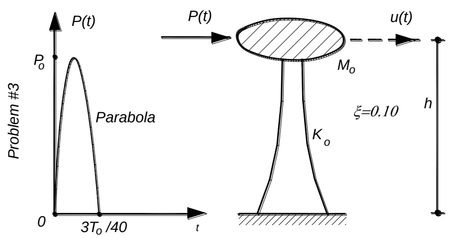
ADVANCED DYNAMICS OF STRUCTURES / HOMEWORK # 1; October 31, 2012

1. Write down the equation of motion of the rigid-body assemblage in terms of $Y(t)$ the vertical displacement of the hinge 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 ($\omega = \bar{\omega}$) 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., $u(t=0)=0$ and $\dot{u}(t=0)=0$ .Find the displacement function $u(0 \le t \le T/2)$ by using the initial conditions and $u(T/2 \le t \le T)$ and $u(t \ge T)$ by using the continuity of the displacement and the velocity, where T is the free vibration period of the system. Draw the displacement variation $u(0 \le t \le 2T)/u_{statik}$ where $u_{statik} = p_o / k$.





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., $u(t=0)=0$ and $\dot{u}(t=0)=0$ $M_o\,\ddot{u}(t) + C_o\,\dot{u}(t) + K_o\,u(t) = P(t)$. Find out the displacement $u(t)$, the velocity $\dot{u}(t)$ and the acceleration $\ddot{u}(t)$. Obtain the maximum shear force and bending moment, where T_o is the free undamped vibration period of the system.. $M_o\,g = 200kN$, $K_o = 1000kN/m$, $\xi = 0.10$, $P_o = 100kN$, $h = 8.0m$.

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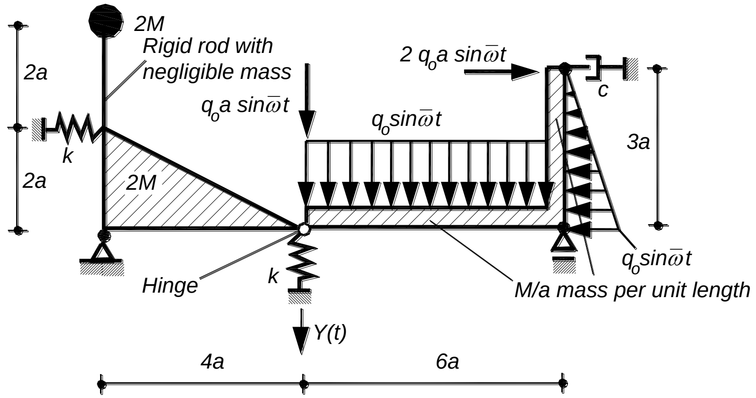

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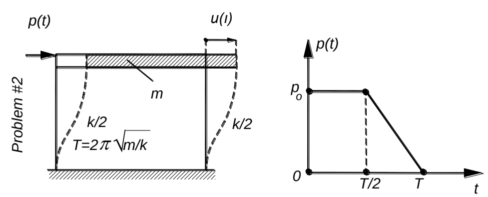

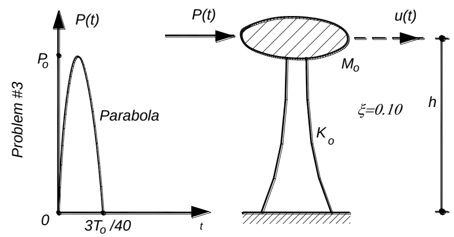

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