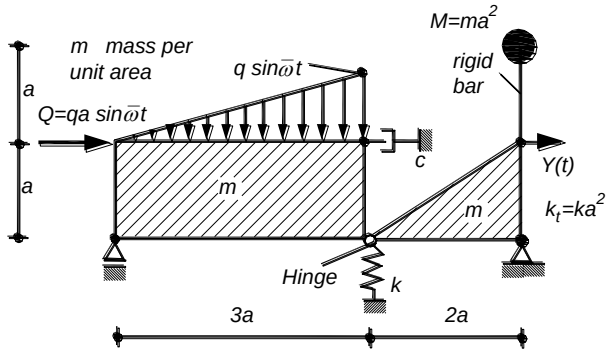
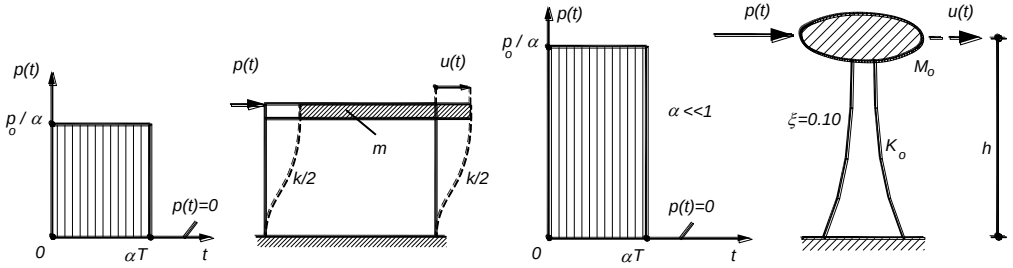
ADVANCED DYNAMICS OF STRUCTURES / HOMEWORK # 1; October 09, 2013

1. Write down the equation of motion of the rigid-body assemblage in terms of $Y(t)$ the horizontal displacement by using the principle of the virtual work. Obtain the free undamped vibration period $T = \alpha\sqrt{M/k}$ of the assemblage and determine α. Find the resonance condition ($\omega = \bar{\omega}$) in terms of the parameters of the undamped system, where m is mass per unit area.



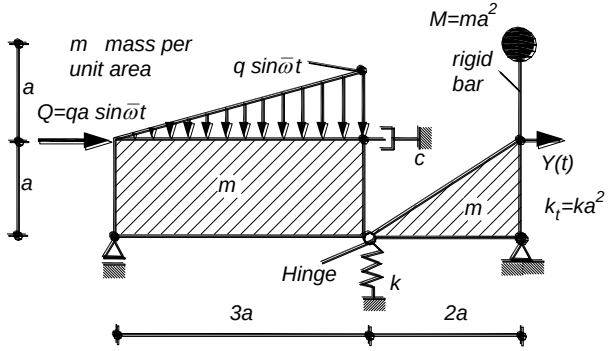
2. A single degree of freedom undamped system of the mass m, the stiffness k is subjected to the external load $p(t)$. The variation of the external load is given as shown. Assuming the system starts from the rest position, i.e., $u(t=0)=0$ and $\dot{u}(t=0)=0$ .Find the displacement function $u(0 \le t \le \alpha T)$ by using the initial conditions and $u(\alpha T \le t \le 2T)$ by using the continuity of the displacement and the velocity, where T is the free vibration period of the system. Draw the variation of $u(0 \le t \le 2T)/u_{static}$ for $\alpha = 1$, $\alpha = 0.5$ and $\alpha = 0.1$ where $u_{static} = p_o / k$.



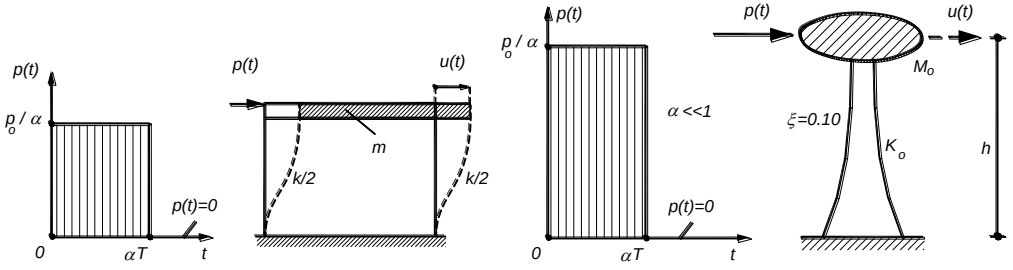
3. The single-degree-of-freedom damped system shown is subjected to an external load of impulse characters by considering that the system starts from the rest, i.e., $u(t=0)=0$ and $\dot{u}(t=0)=0$. Find out the displacement $u(t)$, the velocity $\dot{u}(t)$ and the acceleration $\ddot{u}(t)$ by assuming $\alpha << 1$. Obtain the maximum shear force and bending moment, where T_o is the free undamped vibration period of the system.. $M_o\, g = 100kN$, $K_o = 1500kN/m$, $\xi = 0.10$, $P_o = 100kN$, $h = 8.0m$.

ADVANCED DYNAMICS OF STRUCTURES / HOMEWORK # 1; October 09, 2013

1. Write down the equation of motion of the rigid-body assemblage in terms of $Y(t)$ the horizontal displacement by using the principle of the virtual work. Obtain the free undamped vibration period $T = \alpha\sqrt{M/k}$ of the assemblage and determine α. Find the resonance condition ($\omega = \bar{\omega}$) in terms of the parameters of the undamped system, where m is mass per unit area.



2. A single degree damped 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 $u(0 \le t \le \alpha T)$ by using the initial conditions and $u(\alpha T \le t \le 2T)$ by using the continuity of the displacement and the velocity, where T is the free vibration period of the system. Draw the variation of $u(0 \le t \le 2T)/u_{static}$ for $\alpha = 1$, $\alpha = 0.5$ and $\alpha = 0.1$ where $u_{static} = p_o / k$.



3. The single-degree-of- freedom damped system shown is subjected to an external load of impulse characters by considering that the system starts from the rest, i.e., $u(t=0)=0$ and $\dot{u}(t=0)=0$. Find out the displacement $u(t)$, the velocity $\dot{u}(t)$ and the acceleration $\ddot{u}(t)$ by assuming $\alpha << 1$. Obtain the maximum shear force and bending moment, where T_o is the free undamped vibration period of the system.. $M_o\, g = 100kN$, $K_o = 1500kN/m$, $\xi = 0.10$, $P_o = 100kN$, $h = 8.0m$.