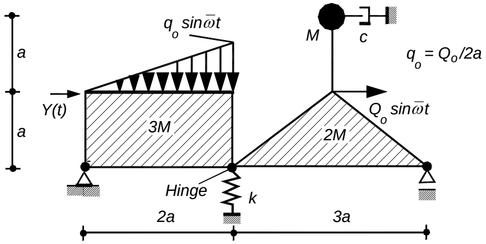
ADVANCED DYNAMICS OF STRUCTURES / HOMEWORK # 1; October 15, 2014

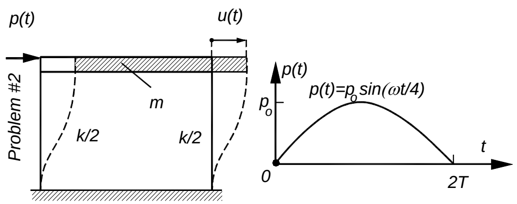
Problem # 1:

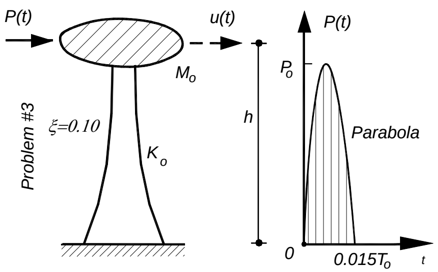
Write down the equation of motion of the rigid-body assemblage in terms of $Y(t)$ the horizontal displacement by using the principle of the virtual work. Obtain the free undamped vibration period $T = \alpha\sqrt{M/k}$ of the assemblage and determine α. Find the resonance condition ($\omega = \bar{\omega}$)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



Problem # 2:

A single degree of freedom undamped system of the mass m, the stiffness k is subjected to the external load $p(t)$, where $p(0 \le t \le 2T) = p_o \sin[\pi t/(2T)]$ and $p(t \ge 2T) = 0$. 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 $u(0 \le t \le 2T)$ by using the initial conditions and $u(t \ge 2T)$ by using the continuity of the displacement and the velocity, where T is the free vibration period of the system. Draw the variation of $u(0 \le t \le 4T)/u_{static}$, where $u_{static} = p_o/k$.





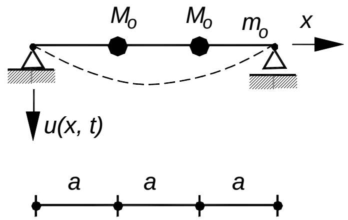
Problem # 3:

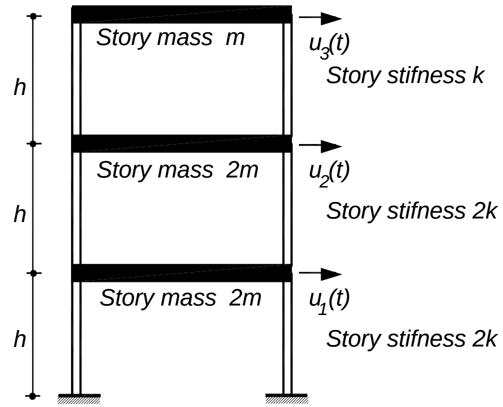
The single-degree-of-freedom damped system shown is subjected to an external load of impulse characters by considering that the system starts from the rest, i.e., $u(t=0)=0$ and $\dot{u}(t=0)=0$. Find out the displacement $u(t)$, the velocity $\dot{u}(t)$ and the acceleration $\ddot{u}(t)$. Obtain the 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 # 2; November 05, 2014

Problem # 1:

Obtain the free vibration frequency of the beam shown having a uniformly distributed mass m_o and two lumped masses M_o by assuming two different shape functions (a) $\psi_1(x) = \sin\dfrac{\pi x}{3a}$ and (b) $\psi_2(x) = x(3a - x)$.





Problem # 2:

Obtain the stiffness matrix, the flexibility matrix and the mass matrix of the frame shown. Evaluate the first two free vibration mode shapes $\boldsymbol{\phi}_1$ and $\boldsymbol{\phi}_2$ and the corresponding circular frequencies ω_1 and ω_2 by using Stodola method. Check the orthogonality conditions $\boldsymbol{\phi}_1^T \mathbf{m}\, \boldsymbol{\phi}_2$ and $\boldsymbol{\phi}_1^T \mathbf{k}\, \boldsymbol{\phi}_2$.