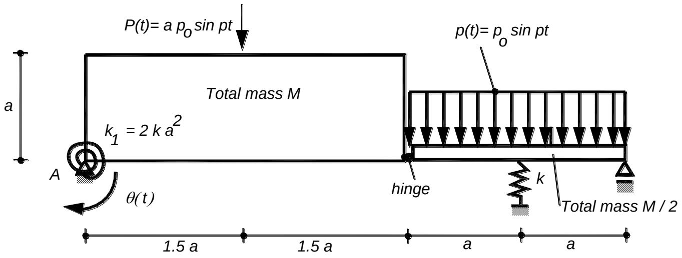
ADVANCED DYNAMICS OF STRUCTURES / QUIZ / November 5, 2008

Problem # 1

For the rigid-body assemblage shown,

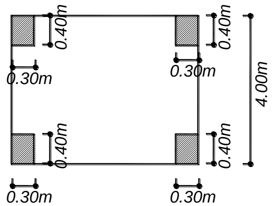
a. Set up the equation of motion in terms of the rotation angle $\theta(t)$ of the point A by using the principle of the virtual work.



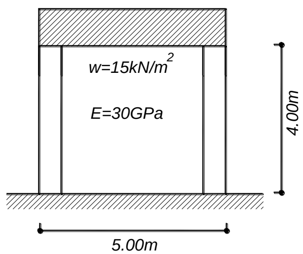
b. By assuming $k_1 = 2\,k\,a^2$ determine the period of the system as $T = \alpha\sqrt{M/k}$ and evaluate α.

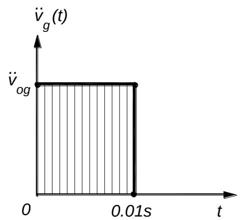
Problem # 2

The single-degree-of-freedom system shown is subjected to a ground motion $\ddot{v}_g(t)$ having a time variation given.



a. Obtain the variation of the displacement $v(t)$ in terms of parameters $\ddot{v}_{go}$, M_o (mass), K_o (lateral stiffness) and T_o (period of the system) by assuming that the ground acceleration can be considered as ***a short-duration impulse*** and that the initial conditions to be $v(t=0)=0$ and $\dot{v}(t=0)=0$. Evaluate the maximum displacement and the maximum of the base shear.





$\ddot{v}_g(t)$

b. Consider the single-degree-of-freedom system shown, evaluate the mass M_o, the lateral stiffness K_o and the period T_o, By considering the ground motion above and assuming $\ddot{v}_{go} = 0.8g$ evaluate the maximum displacement and the maximum of the base shear numerically.

$$m\,\ddot{v} + k\,v = -\,m\,\ddot{v}_g \qquad \omega^2 = k/m \qquad \omega = 2\,\pi/T \qquad I = -m\int_0^{t_o} \ddot{v}_g(t)\,dt$$

$$v(t) = \frac{I}{m\,\omega}\sin\omega\,t \qquad I_\theta = \frac{M}{12}(a^2 + b^2)$$

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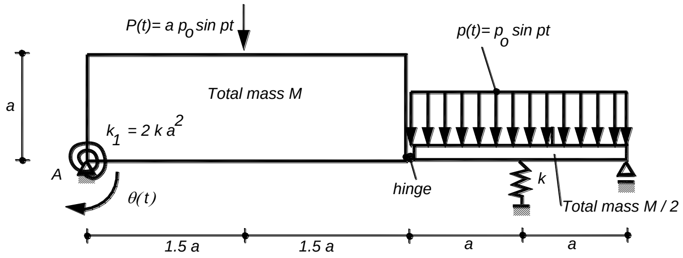

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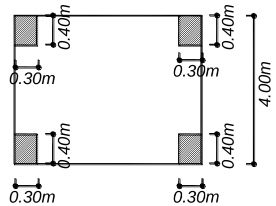

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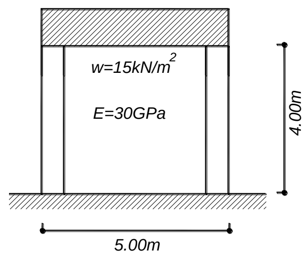

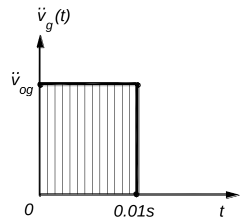

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