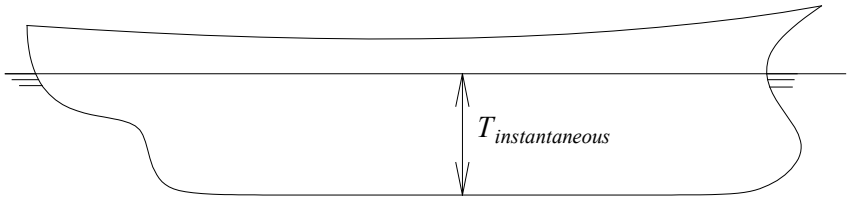
College of Maritime Engineering, Biological, Oceanic and NR Sciences

Ship Vibrations

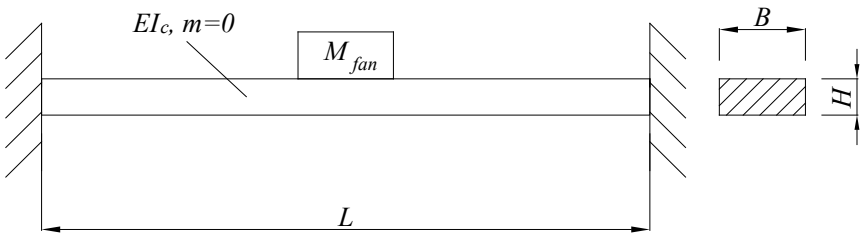
Quiz #2: Damped and forced oscillation 1 dof Nov. 26th, 2021

Student: .....

1.- A tanker ship with the following main dimensions (L_{OA}: 64.3 m, L_{wl}: 60.0 m, B: 12.0 m, D: 6.0 m, T_{design}: 4.0 m, C_B: 0.65, C_{MSect}: 0.90, C_{WPlane}: 0.80) is freely oscillating with pure vertical motion in still water. When the ship is instantaneously in the position shown in the figure, its velocity in the upward direction is 0.5 m/sec and the draft is 4.5 m. Considering that the non-dimensional damping coefficient is 0.15, determine the maximum vertical displacement that the ship reaches. Present a sketch with your results.



2.- On a clamped steel beam 4.8 m long, it is installed a 40 kg fan, which works with an unbalance of 100 kg-mm. The beam has been treated to add viscous damping, and has a sectional inertia of 1.3E-6 m^4; Young modulus of the material may be taken as E: 2.0E11 N/m^2. The machine is tested at several speeds, and it is registered that the maximum steady response has an amplitude of 20.3 mm. Modelling the beam+fan as a 1 degree of freedom system, calculate the fan's steady state vibration amplitude when it operates at 1200 rpm.

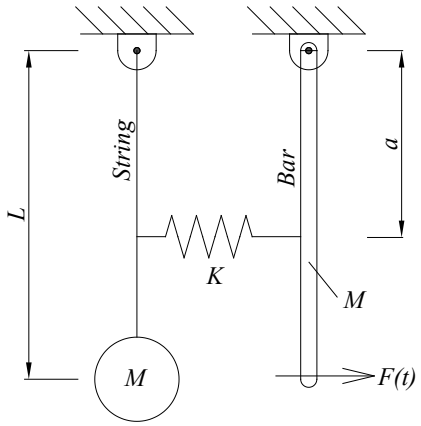


To approximate the effective stiffness of the beam, the deflection of a clamped beam with a concentrated force in the central section is:

$$E\,I_c\,v(x)=\frac{F\left(x-L/2\right)^3\,S\left[x-L/2\right]}{6}-F\,\frac{x^3}{12}+\frac{F\,L}{16}x^2,$$

where $S[\ ]$ is the Step function.

3.- Deduce the equations of motion of the system shown in the figure, which oscillates in the plane. On the lower end of the bar, a harmonic horizontal force, *F(t)*, is acting. Present your result in matrix form, as function of the parameters shown in the figure.



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I certify that during this exam I have complied with Code of Ethics of our university.

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