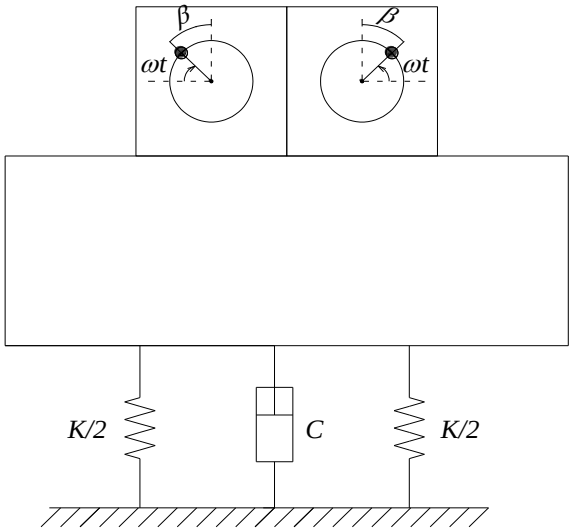
College of Maritime Engineering, Biological, Oceanic and NR Sciences

Ship Vibrations

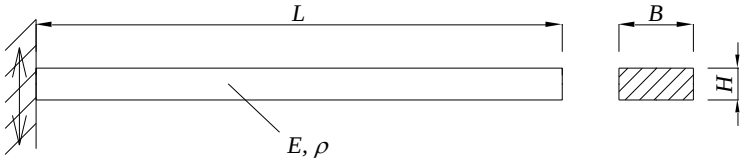
Quiz #2: Damped and forced oscillation 1 dof Dec. 2020

1.- A machine with a mass of 1000 kg is placed on a isolator, that is a spring, of stiffness 1E6 N/m. The machine is given an initial displacement of 5.0 cm and released. After 6 cycles, the amplitude of the oscillation is recorded to be 1.90 cm. Calculate the damping ratio (non-dimensional) of the system.

2.- To determine the vibratory characteristics of a machine and its foundation, it has been installed a counter-rotating eccentric mass exciter on top of it. Mass of the structure is 181.4 kg. With a stroboscopic light, the position of the eccentric masses was observed to be at an angle β of 30º, when the machine was moving upward through its static equilibrium position. The eccentric masses are rotating with a velocity of 888 rpm, with an unbalance on each wheel of 0.0921 kg-m, and the amplitude of the response is 18.45 mm. Determine the non-dimensional damping coefficient of the system.



3.- In the experiment developed in the SiMar lab, an aluminum alloy beam (*L*: 55 cm, *B*: 7.0 cm, and *H*: 3 mm) is forced to oscillate applying a base motion to its clamped end, as shown in the figure. Properties of the beam material are: *E*: 7.1E4 N/mm^2 and ρ: 2673 kg/m^3, and the amplitude of the base motion is 1 mm. The system is modeled as a one dof system with effective mass of 26% of the beam mass located at the tip, a damper with non-dimensional coefficient of 0.03, and, with a spring whose effective stiffness may be deduced from the expression for the vertical deflection due to a concentrated force: $\delta = FL^3/(3EI_c)$. Calculate the amplitude of the vibratory response of the system, in the condition of resonance.



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

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