

Faculty of Maritime Engineering and Marine Sciences

Mechanical Vibrations

Quiz 4 – V-dof, hydrodyn. properties, beam vibrations

Jan. 26th, 2021

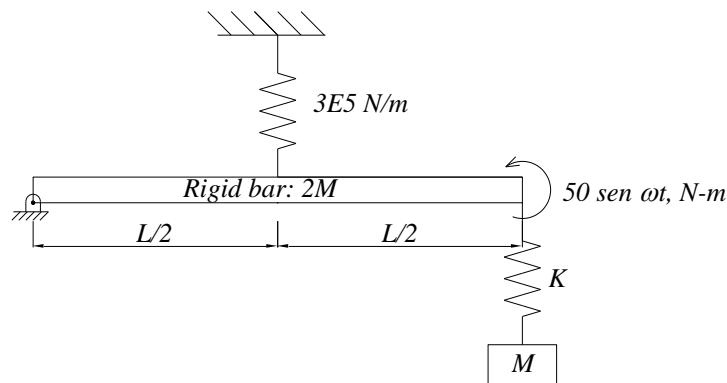
Student:

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Firmo al pie del presente compromiso, como constancia de haber leído y aceptar la declaración anterior. |

1.- Let us consider the oscillation of a 40 cm long rigid bar pinned on its left end, and suspended by a first spring with stiffness $3E5$ N/m, as shown in the figure. An external moment acting on its right end is a harmonic function with frequency 50 rad/sec. Determine the stiffness of the spring which supports the block with mass M on its right end, so that the angular motion of the bar is null. The mass of the rigid bar is 20 kg. (35)

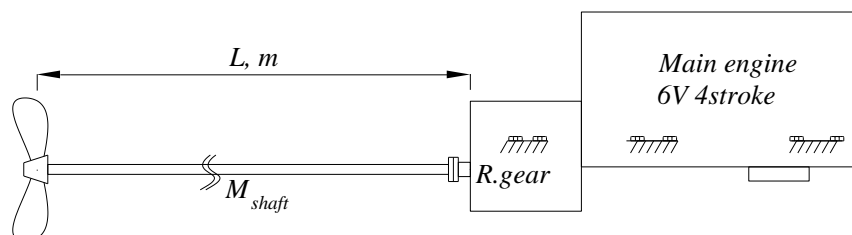


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2.- In a propulsion system, the resonance in longitudinal vibration with the hydrodynamic excitation from the propeller occurs when the engine operates at 937 rpm. The system is composed by a 4-stroke diesel engine with 6 cylinders in V configuration, 750 hp@1200 rpm, reduction gear ratio of 2:1, and a propeller weighing 800 kg with 5 blades. Shaft is 25 meter-long and 15 cm in diameter, with material properties: Young modulus $2.068E11$ N/m², Poisson ratio 0.30 and density 7800 kg/m³. Calculate the added mass of the propeller. (20)

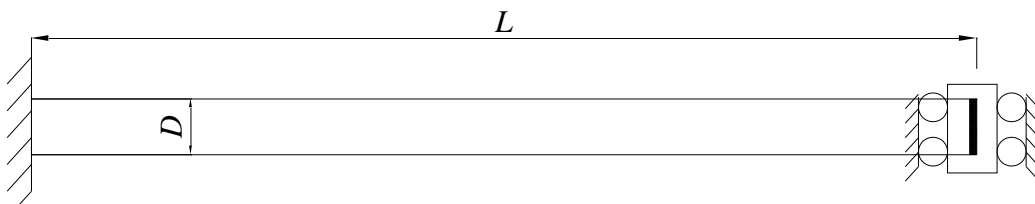


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3.- You are asked to analyze the free vibration of a prismatic aluminum alloy beam of length L and built with a circular tube, which is clamped on one end and guided on the other. After some iterations it is found that one of the principal values $\beta_i L$ is 8.6394. (45)



i.- If the beam is 3.2 meter-long with a section of 10 cm in outside diameter and thickness of 5 mm, calculate the corresponding natural frequency. For the material take Young modulus of $6.89E10 \text{ N/m}^2$, Poisson ratio of 0.33, and specific weight of 25500 N/m^3 .

ii.- Deduce amplitude ratios and prepare a scheme of the corresponding mode shape and identify the number of the mode.

jrm/2021