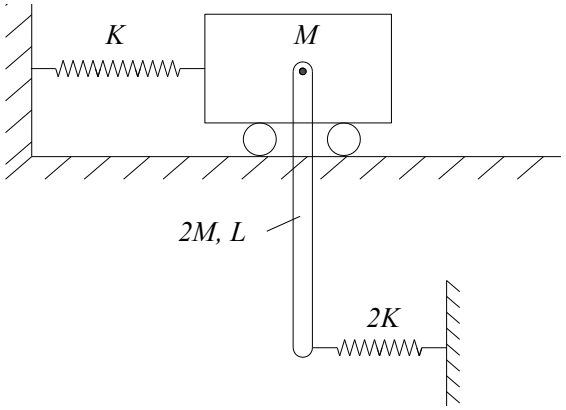
College of Maritime Engineering, and Biological, Oceanical and Natural Resource Sciences

Ship Vibrations

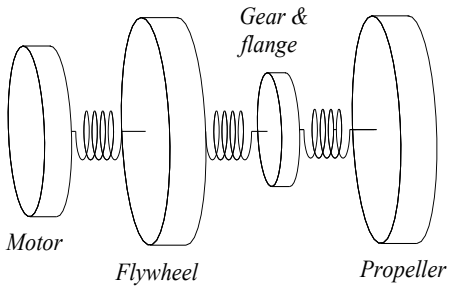
Second Evaluation August 31st, 2018

Student: .....

1.- Deduce the equation of motions of the following system composed of a block of mass *M* that may move horizontally on wheels with no slip, and has a bar pinned on its center. The mass of the bar is *2M* and length *L*, and it is uniformly distributed. The system includes two linear springs of stiffness *K* and *2K*, one connected to the block and the other at the lower end of the bar. (25)



2.- You have to analyze the torsional vibration of a simplified shafting system of a fishing vessel (440 hp @1800 rpm, 6 cylinders, 4 stroke cycle, gear ratio of 2.5:1, Z_{prop}: 4). Employing Holzer method, estimate the second torsional natural frequency different from zero. (25):



Disk	J_i [kg m^2]	K_i [kg*m/rad]
Motor	800	
		1.00E6
Flywheel	1600	
		1.00E6
Gear and flange	500	
		2.00E5
Propeller	1000	

3.- a. Explain in no more than 4 lines, what is entrained water? (10)

b.- Why it is recommended that the number of cylinders of the engine is not a multiple of the number of blades of the propeller? (10)

4.- Analyze the free vibration of a prismatic beam which is clamped in one end and simply supported in the other. After a quick check a principal value is found around $(\beta_i L)^2 \approx 49.965$. You are asked to: (30)

i.- calculate the corresponding natural frequency if the beam is built from an steel tube (L= 3 m, D_o=10 cm, t=3 mm, and γ =76440 N/m^3), and

ii.- plot the mode shape and identify at what ith order correspond.

jrml/2018

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

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