College of Maritime Engineering, and Biological, Oceanical and NN.RR. Sciences

Ship Structures I

1st Evaluation, II 2016 December/09/2016

Student: ……

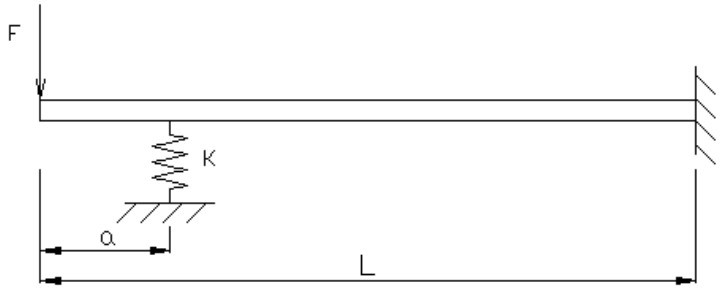
1.- You are asked to analyze the shear and normal stress distributions in the transverse section of an steel box barge, main dimensions: L= 50, B= 10, D= 4, and T= 2.5 m, floating in fresh water, γ: 1.00 ton/m^3, which includes a 1-m height double bottom, and with constant thickness, as it is shown in the figure. (30)

i. Calculate maximum Bending moment and Shear force that the section can support.

ii. Prepare a sketch of the longitudinal equilibrium of the section segment with a cut a, at the double bottom plate, for a positive shear force.

t: 8 mm

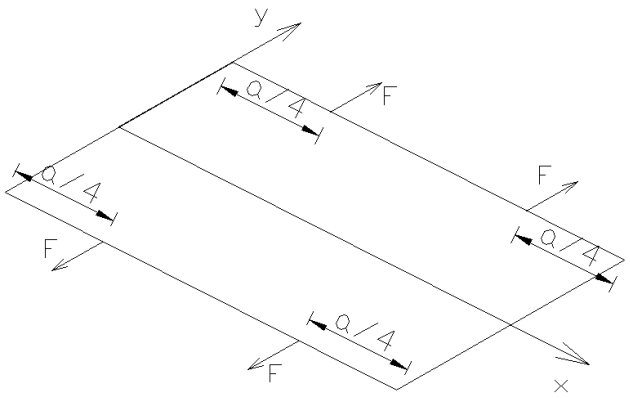
2.- Energy methods: The following is the model to analyze the bending of a 800 hp/250 rpm propulsion shaft in a ship, with a deformable (external to the hull) support represented by a spring, with stiffness K. Considering as load only the weight of the propeller, F, apply Castigliano's method to calculate one of the reactions of the system, and then estimate the maximum normal stress on the shaft. Consider the following main characteristics for the system: L: 4 m, a: 0.5 m, K:1.0 MN/mm, F (Prop.Weight): 200 kg, and $diam_{shaft}$: 15 cm. (25)



3.- Plane stress: Consider a rectangular flat plate of 8 mm constant thickness, supporting four concentrated forces on its x-edges, as shown in the following figure. Each force F is 250 kN, and plate dimensions are: a= 2 m, and b= 1 m.

a) Determine the amplitudes of the first two harmonics, q_1 and q_2, to represent the load function as a sinusoidal series, and explain your results. (10)

b) Use the values determined in the previous step to calculate the displacement in the x-direction, on the horizontal centerline, that is *u(x, y=0)* with respect to the displacement of the origin. Plot and comment your results. (25)



4.- Give translation of the following technical terms: (10)

Momento Flector ……... Fuerza Cortante ……..……..

Mamparo Estanco …….....……

Pandeo …… Viga ……..……

From class notes: $C_1 = \frac{2A}{\alpha^2}\ \frac{senh\alpha b + \alpha b \cosh \alpha b}{senh\,2\alpha b + 2\alpha b}$, $C_4 = -\frac{2A}{\alpha^2}\ \frac{\alpha senh\,\alpha b}{senh\,2\alpha b + 2\alpha b}$.

$$\sigma_x(x,y) = \sum_{m=1}^{\infty} 2q_m sen\,\alpha_m x \left[\frac{(\alpha_m b \cosh \alpha_m b - senh\,\alpha_m b)\cosh \alpha_m y - \alpha_m y\, senh\,\alpha_m b\, senh\,\alpha_m y}{senh\,2\alpha_m b + 2\alpha_m b} \right]$$

$$\sigma_y(x,y) = \sum_{m=1}^{\infty} -2q_m sen\,\alpha_m x \left[\frac{(\alpha_m b \cosh \alpha_m b + senh\,\alpha_m b)\cosh \alpha_m y - \alpha_m y\, senh\,\alpha_m b\, senh\,\alpha_m y}{senh\,2\alpha_m b + 2\alpha_m b} \right]$$

$$\tau_{xy}(x,y) = \sum_{m=1}^{\infty} -2q_m \cos \alpha_m x \left[\frac{\alpha_m b \cosh \alpha_m b\, senh\,\alpha_m y - \alpha_m y\, senh\,\alpha_m b \cosh \alpha_m y}{senh\,2\alpha_m b + 2\alpha_m b} \right]$$

jrml/2016

I declare that during this exam I have fulfilled the Code of Ethics of our university.

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