College of Maritime Engineering and Sea Sciences

Ship's Structure

Second Quiz: Shear stress in bending & Energy methods   July 4th, 2023

Student: .... Student ID: ....

Closed books

1. To increase the bending rigidity to support a load, two C 380x60 steel profiles (381x86 & 13/18 mm) are joined by screws as shown in the figure below on the left. The steel screws are 17 mm in diameter and are spaced 200 mm along the length of the beam (see figure on the right). Considering that the maximum shear stress that the material of each screw can support is 100 N/mm², calculate the maximum shear force that may be applied on the section. (30)
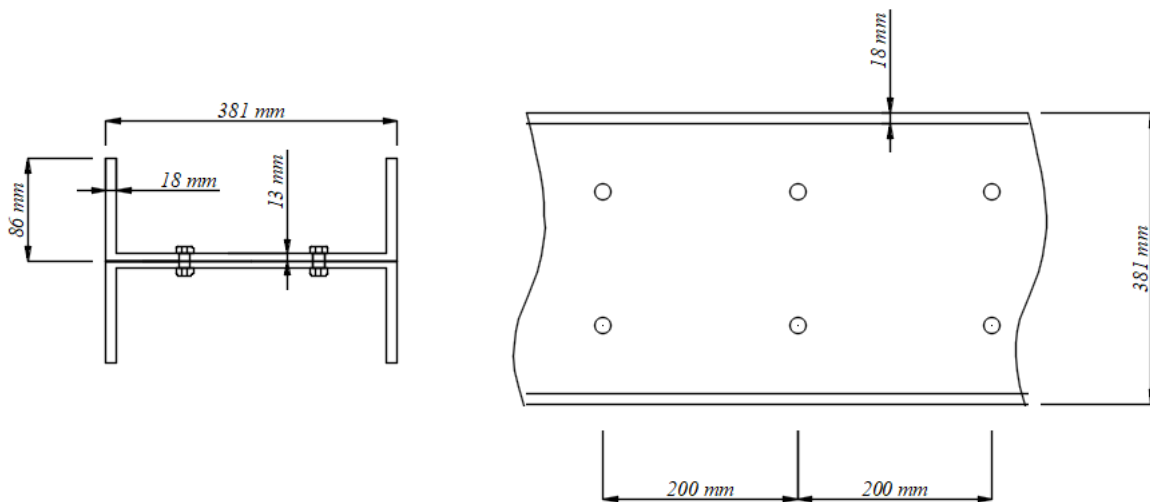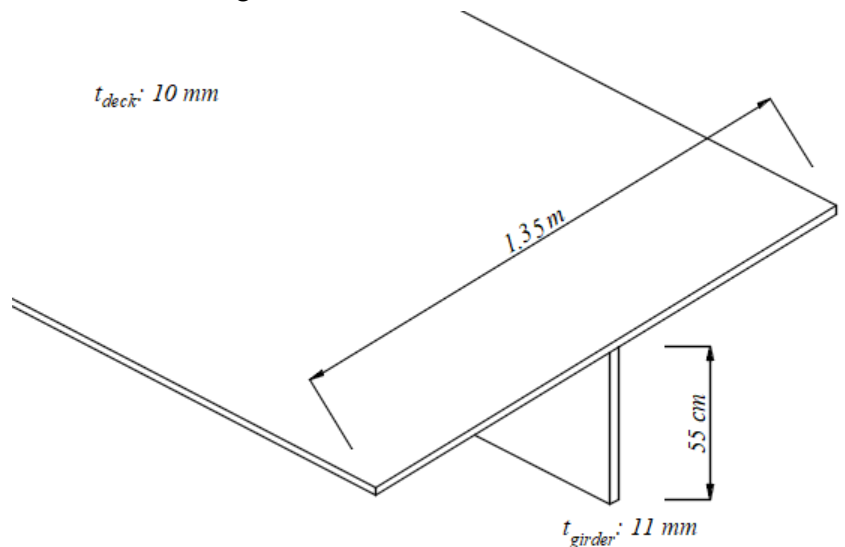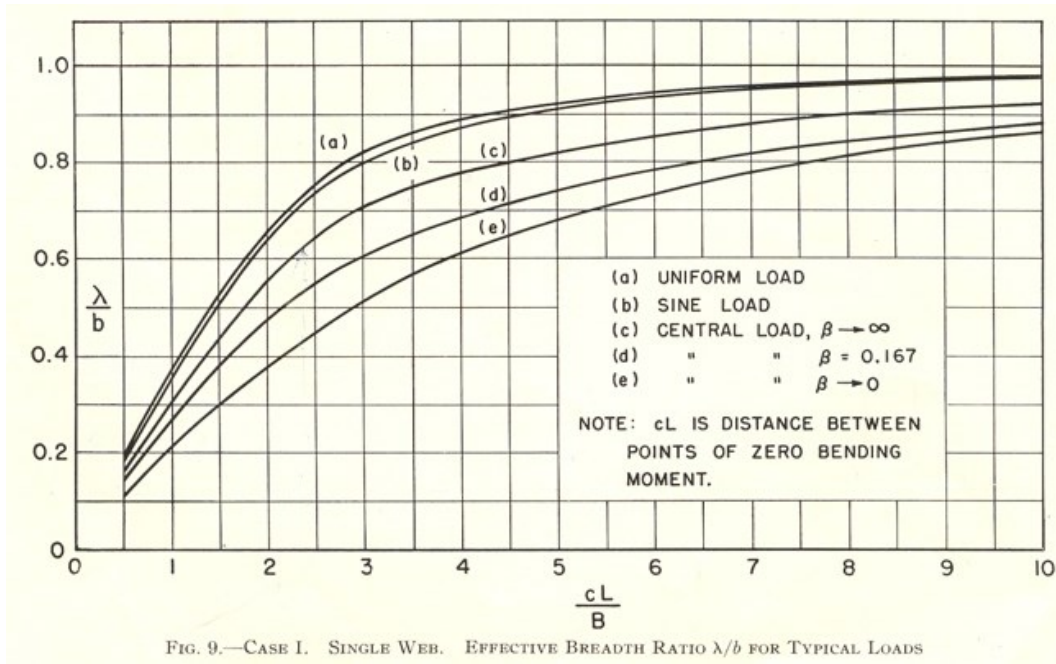

2.- Estimate the maximum normal stress in a combination of transverse girder and the deck plate to which it is welded, in a tanker ship. To simplify calculations, consider that the girder is formed by a vertical plate, 55 cm height and thickness of 11 mm. Pressure acting on the deck, according to a classification society is 16.71 kN/m², and the girders are separated 1.35 meters. The ship has a beam of 14 meters and it includes a longitudinal bulkhead. To calculate the effectiveness of the deck plate, attached is Schade's figure for case I, that is, beams with single web.

In this case, the girder is modelled as clamped-clamped beam, with uniformly distributed load, so the distribution of bending moment is:
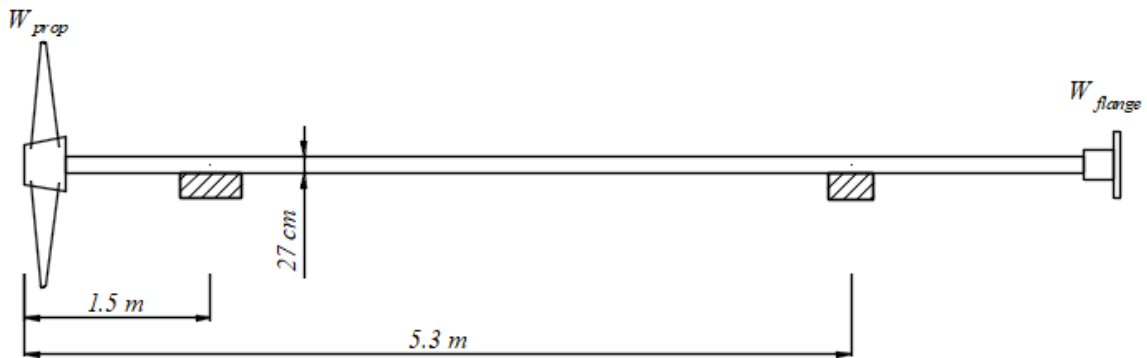
$$M_z(x) = p_o L^2 \left[-\frac{1}{2}\left(\frac{x}{L}\right)^2 + \frac{1}{2}\left(\frac{x}{L}\right) - \frac{1}{12} \right]$$

(35)

FIG. 9.—CASE I. SINGLE WEB. EFFECTIVE BREADTH RATIO λ/b FOR TYPICAL LOADS

3.- Using Rayleigh-Ritz method, approximate and plot the distribution of bending moment in a 7.5-meter long marine propulsion system (B/T Isla La Plata) which is supported by two bearings. Weight of the propeller is 20950 N, the coupling flange is 2045 N, and for this simplified calculation weight of the shaft is neglected. Diameter of the shaft is 27 cm. To approximate the deflection function, you must use at least a *third order polynomial*, and in case you do not remember, the sectional inertia of a circular section is $\pi D^4/64$. Material of the shaft is steel. (35)