Part A:


2. Shames (13.10 Text) Problem 11.53.

Part B: Shear Flow for a Lateral Load along the Y axis.

a) Calculate the shear flow around the half-breadth midship section shown above using the shear force for the midship section calculated in PS2. **DO NOT ignore the effects of the stiffeners and girders.** Given the yield stresses for medium or ordinary strength steel, determine whether or not the deck members fail due to shear stress. If a deck member does fail, determine what thickness is necessary to prevent failure. $I_{yy} = 7670 \text{ ft}^4$. Hint: Rather than treating each stiffener and girder as an open section, “lump” the stiffener and girder areas. See PNA Vol. 1, Ch. IV, Section 3 for details.
**Part C:**

In the lecture on bending without twist, we derived the location of shear center:

\[
\int y_D \frac{Q_z h_c \, ds + I_z Q_y h_c \, ds}{(-I_{zy}^2 + I_y I_z)} - \int z_D \frac{-I_y Q_z h_c \, ds + I_{zy} Q_y h_c \, ds}{(-I_{zy}^2 + I_y I_z)}
\]

in the lecture on pure twist, we derived the location of the center of twist:

\[
y_D := \frac{\left(I_{yo} z - I_{yz} z_{zo}\right)}{\left(I_y I_z - I_{yz}^2\right)} \quad z_D := \frac{\left(I_{zo} y + I_{yz} I_{yo}\right)}{\left(I_y I_z - I_{yz}^2\right)}
\]

Show that these are identical.

Hint: integration by parts can be applied to the second moments of inertia, establishing equivalence with an integral of the first moment of area; e.g.

\[
I_z = \int_0^b y \cdot y \, dA = -\int_0^b Q_z \, dy
\]