MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Mechanical Engineering

2.701 PRINCIPLES OF NAVAL ARCHITECTURE
Fall 2014

PROJECT #7: HULL STRUCTURE

Date issued: November 12, 2014
Date Due: November 24, 2014

1. Assignment

The scope of this project is to i) familiarize yourself with the American Bureau of
Shipping (ABS) rules and regulations for building and classing steel vessels, and ii)
quantify the mid-ship section's structural strength.

The following ship characteristics are given:

Ship type: Product Carrier
L_{OA} = 175.50 m
L_{BP} = 163.40 m
L_{WL} = 170.00 m
B = 25.00 m
D = 15.00 m
d = 11.18m (molded draft)
T_d = 10.80 m
C_B = 0.82
V_S = 14.75 knots
s = 750mm (spacing of transverse frames or longitudinals)
Framing: Longitudinal

Procedure:

I.   Using "ABS Rules for Building and Classing Steel Vessels 2000" compute the thickness/size for the following structural elements (In parenthesis the corresponding section in the ABS rules is given):

- Bottom shell plating – (§3/2/2.3.13.2) pg. 69
- Plate keel – (§3/2/2.3.15)
- Inner - bottom plating – (§3/2/4.9.1)
- Side Shell Plating – (§3/2/2.3.9)
- Sheerstrake – (§3/2/2.3.11)
- Main deck plating – (§3/2/3.5.1)
- Main deck stringer plating - (assume same thickness with main deck)
- Side tanks plating (§3/2/9.5.1) (assume that yield point Y=235N/mm^2 and α = 15/13.3 = 1.128)
- Bottom center girder – (§3/2/4.3.3.1)
- Bottom side girders – (§3/2/4.3.9)

For the thickness calculations round each result to the closest larger mm, e.g. t=11.3mm should be rounded t=12mm.

II.   In the provided .dwg file for the mid-ship section, the exact position, number and size of the longitudinals is given. Using the Dimension or Analyze menu in RHINO 3D at the top of the window you can measure all the distances you need from the baseline for each element.

Create a table with all the elements that contribute to the longitudinal strength of the ship and calculate the position of the neutral axis, the mid-ship section's moment of inertia, as well as the section modulus SM_{top} and SM_{bottom}. You can start using the attached .xls file which also contains useful information about the longitudinals (such as thickness etc.). *You can obtain all the geometrical information that is not included in the .xls using the .dwg file.*

Note: In the attached .xls file:
- b is the breadth of each element and t is the thickness
- Y is the distance of the neutral axis of each element from the baseline
- h is the vertical projection of each element
- for the longitudinals "web" is the long side and "flange" the short one.

Deliverable:
A technical report showing in detail the calculations for the structural elements in part I and the .xls file containing all the calculations requested in part II.

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