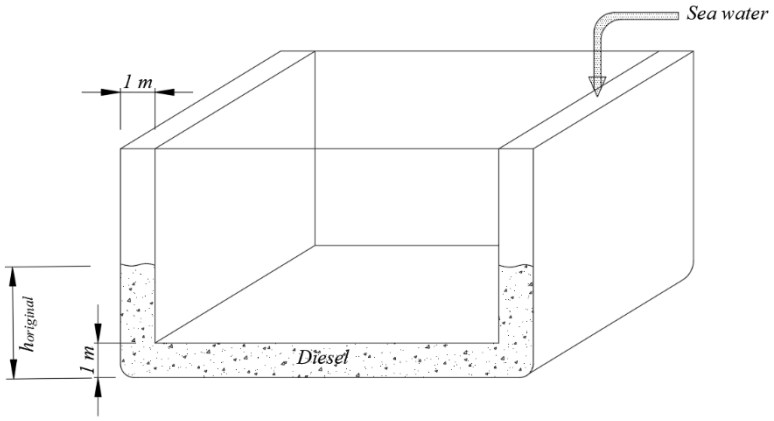
Faculty of Maritime Engineering and Marine Sciences

Ship Dynamics

Quiz 2 – Ship response in the vertical plane July 08th, 2022

Open books

1.- In a tuna fishing vessel (*L*: 62 m, *B*: 14 m, D: 7.0 m, T: 4.25 m), it is installed a diesel tank in the double hull, spec. gravity=0.85; spacing of the external and internal hulls is 1 meter, uniform. The length of the tank is 5 m and the original height of diesel measure from the base line is 3.0 m. If by error in the valve operation located on the starboard side of the vessel, a volume of 5 m3 of sea water is pumped in this tank, but the two fluids do not mix. What would be the height of the liquid on the port side? Apply Bernoulli's equation for this calculation.



a. 3.60 m
b. 3.30 m
c. 3.00 m
d. 2.50 m

2. The following equations were deduced for the velocities of a potential flow of a fluid in a 2D converging nozzle, where *L* is a reference distance and U_o is the velocity in free flow:

$$u = U_o\left(1 + \frac{x}{L}\right), \quad v = -U_o\frac{y}{L}$$

Calculate the acceleration at a point *(x, y) = (L, L)*.

You may need the expression for the total derivative of a vector function:

$$\frac{D\vec{v}}{Dt} = \left(\frac{\partial}{\partial t} + \vec{v}\cdot\nabla\right)\vec{v}.$$

a. sqrt(5) Uo**2 / L
b. 0.0
c. sqrt(3) Uo**2 / L
d. Uo**2 / (4L)

3.- The beam distribution of a ship is approximated by the following polynomial, with the origin at midship and L: 70 m, *B*: 14 m, *D*: 7 m and *T*: 3.5 m, C_B: 0.65, C_{SEC}: 0.72:

$$B(x) = 14 - 0.00771x^2 - 0.000106x^3$$

Calculate the coefficient C_{55} using the reference system employed in class.

a. 2393 MN-m
b. 1893 MN-m
c. 1393 MN-m
d. 893 MN-m

4.- Consider a box barge navigating in beam seas at a velocity of 12 knots around Galápagos islands. Main dimensions of the vessel are L=50 m, B= 10 m, T= 3.5 m C_B=1.0 and C_{Sect}=1.0. Calculate the wave length for resonance in heave motion. Added mass can be estimated as 0.8M, where *M* is the dry mass.

a. 39.58 m
b. 44.00 m
c. 49.58 m
d. 54.00 m

Problem

5.- A barge with quadratic water plane (see equation below) and semicircular sections (L: 60 m, B: 10, T: 5 m, and no trim) is resting in the sea with engines stopped. When this vessel receives regular head waves of 120 m long, the following parameters are calculated: A_{33}=1.7E6 kg, A_{55}=2.42E8 kgm^2, B_{33}=4.10E5 Ns/m, B_{55}=6.13E7 Nms, F_3=1.93E6+i1.64E6 N and F_5=-1.764E7-i2.419E7 N-m. Calculate the rest of parameters to estimate the vertical acceleration of the fore and aft ends of the ship.

$$B(x) = B\left(1 - \left(\frac{2x}{L}\right)^2\right)$$

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