

2.20 Problem Set 12

Name: _____

1. Supplementary Problem Va25

2. Marine Hydrodynamics (JNN), Problem 3.7. Indicate whether quantities will increase or decrease and explain why. Assume a turbulent boundary layer.

3. The total resistance of a ship of length $L_s = 200$ m moving at a design speed of $U_s = 10$ m/s is to be estimated using a model of length $L_m = 2$ m. The total wetted surface area of the ship is $S_s = 10^4$ m². For this problem, assume that the properties of the fluid in the towing tank and the ocean are the same and given by $\rho = 1000$ kg/m³ and $\nu = 10^{-6}$ m²/s. Use $g = 10$ m/s². Ignore any roughness corrections.

(a) If the total drag on the model for the design condition is $D_m = 10$ N, find the total resistance D_s of the prototype ship at design speed. Use the ITTC friction line formula:

$$C_f = 0.075(\log_{10} R - 2)^{-2}.$$

(b) To understand the details of the flow, a pressure probe is mounted below the bow of the model. If the pressure measured has an amplitude of P_m and a period of oscillation T_m (due probably to wave breaking at the bow), what will be the prototype values P_s and T_s at that point in terms of P_m and T_m ?