Ship Hydrodynamics

Midterm Exam I

Oct. 23, 2014

Time : 1.5 hours

One page of formulation sheet of A4 is permitted to be used in the exam (excluding explanations and sample problem solutions)

Grading: Q1: 20, Q2: 25, Q3: 25, Q4: 30

1. In a towing tank model test, a torque (turning moment) of Mm= 39.5 Nm is measured. What would be the full-scale moment Ms according to Froude’s law of similarity? (Model scale λ= 30, ρm= 1000 kg/m3, ρs= 1025 kg/m3).
2. Geometrically similar two ships, A and B, have displacement masses 8000 tons and 12000 tons, respectively. The resistance of ship A is 147.5 kN at the service speed of 12 knots. It is known that the ratio of frictional resistance to total resistance (for both ships at their corresponding service speeds) is 0.60. In this case calculate; the corresponding service speed of ship B, residual resistance and total resistance of ship B and as well as effective power of ship B at the corresponding service speed.

(ρ = 1025 kg/m3, SA = 2650 m2 )

3) (a) Calculate the coefficients of frictional resistance CFs, wave resistance CW and total resistance CTs of a full-scale ship using the ITTC-1978 resistance prediction method. Use the following ship data and model test results:

LWLs = 154.6 m, wetted surface area Ss = 5670 m2, model scale λ = 26, form factor (1+k) = 1.280, surface roughness ks = 150\*10-6 m, measured total resistance of model RTm = 75.9 N at model scale velocity Vm = 2.018 m/s. (ρm= 1000 kg/m3, ρs= 1025 kg/m3, νm= 1.02333\*10-6 m2/s, νs= 1.18732\*10-6 m2/s).

**(b)** Calculate the total ship resistance and give the required effective power in kW and HP at the corresponding ship speed.

**4) (a)** Give the name of the statistical methods to calculate the resistance of fishing vessels.

**(b)** Is it possible to calculate viscous resistance of a slender ship by Thin-Ship Theory (Michell’s integral)? Why?

**(c)** Explain adverse pressure gradient and its effect and role on the flow separation.

Good luck

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