EXAM TASKS OF THE COURSE MEC-E2001 - SHIP HYDRODYNAMICS

13 OF DECEMBER, 2017

1. RESISTANCE OF A FAST CATAMARAN (4P)

Evaluate resistance of a fast catamaran at speed 42 knots knowing the following:

Speed	V_S = 42 knots
Waterline length	L_W = 110 m
Wetted surface	S_S = 3250 m^2
Sea water density	ρ_S = 1015 kg/m^3
Sea water viscosity	v_S = 1.16·10^{-6} m^2/s
Model scale	λ = 16
Model basin water density	ρ_M = 1000 kg/m^3
Model basin water viscosity	v_M = 1.02 10^{-6} m^2/s
Measured resistance of the model at a speed corresponding to 42 knots	R_{TM} = 818 N

Additional resistance coefficient C_A = 0. Disregard aerodynamic drag. Apply the so-called ITTC-57 extrapolation method.

HINT: 1 knot = 0.5144 m/s, $Rn = \dfrac{VL}{v}$, $C_F = \dfrac{0.075}{(\log Rn - 2)^2}$

2. DIMENSIONAL ANALYSIS   (4P)

The seakeeping model tests were conducted for the RoPax vessel. The model scale was 49. At the model speed V_M = 0.5 m, the following quantities were measured:

Acceleration   0.1 m/s^2

Wave-impact pressure at the bow 2·10^4 Pa

Wave-impact force at the bow   40 N.

What are the corresponding values in the ship's scale? What is the corresponding ship speed?

3. WHAT DOES IT MEAN?: THE PROPELLER IS TOO LIGHT (3P)

4. THRUST DEDUCTION (4P)
- Physical meaning
- Definition

5. DISCUSS THE EXPRESSION FOR THE PROPULSIVE EFICIENCY (4)

$$\eta_D = \frac{1-t}{1-w}\,\frac{T\,V_A}{2\pi\,n\,Q} = \eta_H\,\eta_B = \eta_H\,\eta_0\,\eta_R$$

In particular, explain how the number of propellers affects the propulsive efficiency.

6. THE SCALE EFFECT ON SHIP WAKE (2+3)

Both figures below represent axial nominal wake. Which of them is the direct result of model test and which is the extrapolation to full-scale? Discuss your answer. (2)

How does hull wake affect propeller-induced vibratory excitation and noise? (3)