

NAME 324: Resistance and Propulsion of Ships Sessional

Assignment: Calculation of Ship Wake

The wake distribution is measured on a model ship in the propeller plane. The particulars of model ship & propeller are given below:

Length of model ship = 7.25m, Breadth of model ship = 1.075m, Draft of model ship = 0.43m, Block Coefficient, $C_b = 0.6$

Diameter of model propeller = 0.25m, Hub diameter of model propeller = 0.05m

Wake velocity is represented as Fourier series, $\omega(x, \theta) = A_0 + \sum_{n=1}^{\infty} [A_n \cos n\theta + B_n \sin n\theta]$; where θ is zero vertically upward and positive clockwise when looking downstream, values of A_n & B_n are given in Table 1.

Table 1: Harmonic content of wake for the propeller.

n	0.25		0.35		0.45		0.55	
	A_n	B_n	A_n	B_n	A_n	B_n	A_n	B_n
0	1.0000		1.0000		1.0000		1.0000	
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0047	0.0286	0.0084	0.0340	-0.0014	0.0260	-0.0217	0.0103
3	0.0488	-0.1387	0.0529	-0.2032	0.0386	-0.2186	0.0169	-0.2103
4	0.0023	-0.0950	0.0067	-0.1539	0.0126	-0.1796	0.0169	-0.1852

n	0.65		0.75		0.85		0.95	
	A_n	B_n	A_n	B_n	A_n	B_n	A_n	B_n
0	1.0000		1.0000		1.0000		1.0000	
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	-0.0299	0.0024	-0.0226	0.0040	-0.0064	0.0089	0.0021	0.0077
3	0.0025	-0.2070	0.0015	-0.2200	0.0081	-0.2439	0.0092	-0.2518
4	0.0139	-0.1945	0.0048	-0.2110	-0.0031	-0.2230	-0.0128	-0.2356

Find:

- Values of $\omega(x, \theta)$ for $\theta = 0, 45, 90, 135$ and 180 degrees.
- Represent the wake distribution in graphical form in the following way:
 - θ vs. $\omega(x, \theta)$ for constant X values ($X=r/R=0.25, 0.35, 0.45, 0.55, 0.65, 0.75, 0.85, 0.95$)
 - θ vs. $\omega(x, \theta)$ for constant $\omega(x, \theta)$ values (0.3, 0.4)
 - x vs. $\omega(x)$ as mean radial distribution
 - x vs. $\omega(x)$ as mean nominal distribution
- Comment on the general shape of the hull
- Using Harvald's diagram calculate effective wake, $\omega_{effective}$

Note: Hand written report is preferable. Printed/copied report may be penalized. Report should be submitted in due time otherwise marks will be deducted on the basis of delay.

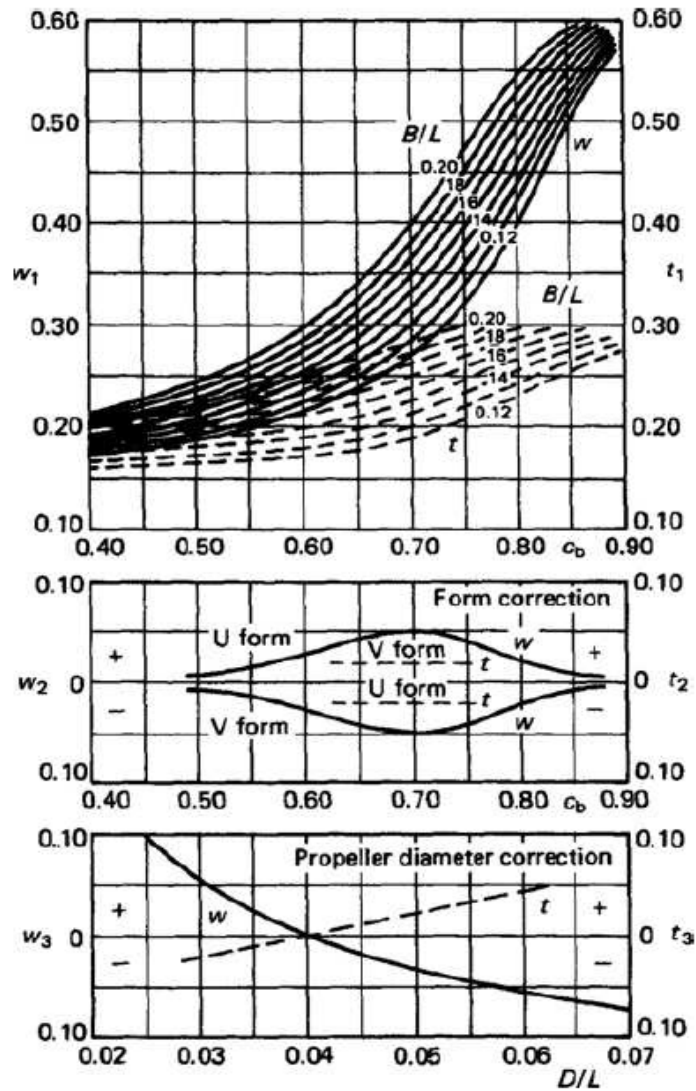


Fig.1: The wake and thrust deduction coefficient for single screw ships (Harvald's diagram)