Systematic Ferry Series

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Abstract

A number of seventeen models of Ferry in scale 1: 28.750 of 10250 ton displacement have been built at the Italian Model Basin, to be tested in the Emilio Castagneto towing tank at INM in Rome. The results of the tests have been collected, delivered and presented in easy and useful form[4].

Keywords: Systematic series.

The hull C2054 (Figure 1) has been used to build the whole Series, the variations in the forms have been obtained maintaining the same displacement, operating the deformation of the hull in the x, y, z directions (Figure 2) using the following parameters:

p = L derived hull / L generating hull
q = B derived hull / B generating hull
r = T derived hull / T generating hull

The derived hulls have all constant volume, while the product $p \cdot q \cdot r = 1$. Table 1 summarizes their main characteristics.

Table 1: The 17 models of the Systematic Ferry Series.

Hull	**L**	**B**	**T**	**p**	**q**	**r**	**ie /2**	**S / $V^{2/3}$**
ID	m	m	m	-	-	-	degree	-
2052	3.7411	0.8797	0.2484	1 / 1.3	√1.3	√1.3	16.78	5.918
2053	4.2655	0.8239	0.2325	1/√1.3	^{4}√1.3	^{4}√1.3	13.91	6.256
2054	4.8634	0.7716	0.2177	1	1	1	11.50	6.657
2055	6.3224	0.6767	0.1909	1.3	1/√1.3	1/√1.3	7.82	7.623
2056	4.8634	0.5935	0.2830	1	1/1.3	1.3	8.89	6.657
2057	4.8634	0.8797	0.1909	1	√1.3	1/√1.3	12.5	6.924
2058	4.8634	1.0030	0.1675	1	1.3	1/1.3	14.81	7.356
2159	4.8634	0.6767	0.2484	1	1/√1.3	√1.3	9.80	6.648
2160	6.3224	0.7716	0.1675	1.3	1	1/1.3	8.89	7.907
2161	6.3224	0.5935	0.2177	1.3	1/1.3	1	7.10	7.522
2162	5.5451	0.8797	0.1675	√1.3	√1.3	1/1.3	11.50	7.634
2163	5.5451	0.5935	0.2484	√1.3	1/1.3	√1.3	7.82	7.084
2164	5.5451	0.7226	0.2039	√1.3	1/^{4}√1.3	1/^{4}√1.3	9.49	7.168
2165	3.7411	1.0030	0.1909	1/√1.3	1.3	1/√1.3	16.78	6.628
2166	3.7411	0.6767	0.2830	1/√1.3	1/√1.3	1.3	11.50	6.377
2167	3.2812	1.0030	0.2177	1/1.3	1.3	1	18.97	6.153
2168	3.2812	0.7716	0.2830	1/1.3	1	1.3	14.81	5.868

Figure 1: The hull model 2054.

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[4] The results will be presented @NAV2022 (15-17 June, 2022).

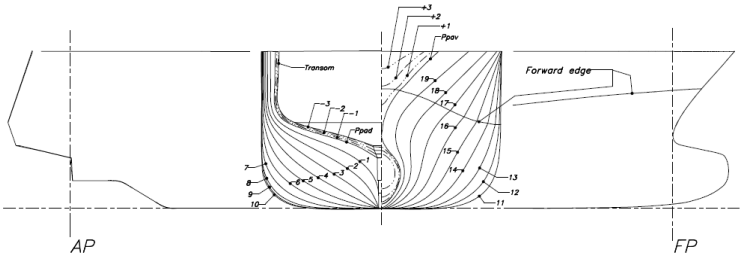

Figure 2: The generating forms of the Series Models.

The models are represented in the $L/V^{1/3}$ and B/T plane in Figure 3.

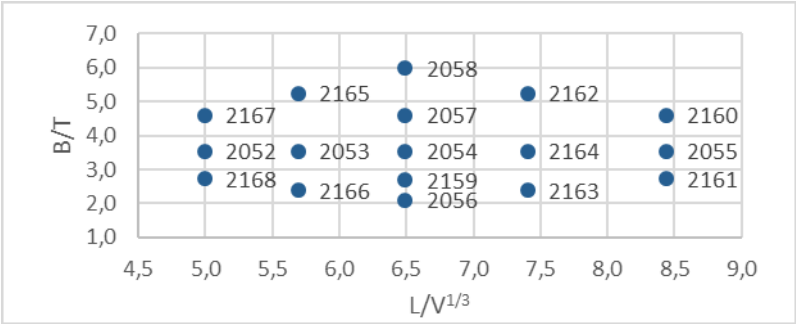

Figure 3: The 17 models in the $L/V^{1/3}$ B/T plane.

The wetted surface and the entrance angle are free of any variation, while the L/B ratio depends on the block coefficient, the $L/V^{1/3}$ and B/T coefficients, with $L/B = [C_B \cdot L^3/V \cdot T/B]^{1/2}$. The wetted surface has been measured for all the hulls; with these values has been obtained a 2nd degree polynomial surface fitting, where the $S/V^{2/3}$ surface is function of $L/V^{1/3}$ and B/T, independent variables:

$$\frac{S}{V^{\frac{1}{3}}} = 4.246 + 0.5085 \cdot \frac{L}{V^{\frac{1}{3}}} - 0.5757 \cdot \frac{B}{T} - 0.09741 \cdot \left(\frac{L}{V^{\frac{1}{3}}}\right)^2 + 0.03287 \cdot \frac{L}{V^{\frac{1}{3}}} \cdot \frac{B}{T} + 0.06757 \cdot \left(\frac{B}{T}\right)^2$$

The resistance towing tests, performed with the seventeen models, give us the residual resistance coefficient as function of the Froude number, C_R=f (FR). We collected these results in 5th degree polynomial equations, to interpolate the C_R for any desired speed. The polynomial equations are here shown in Table 2:

Table 2: The residual resistance coefficients at different Froude number:

	FR=0.150	FR=0.175	FR=0.200	FR=0.225	FR=0.250	FR=0.275	FR=0.300	FR=0.325	FR=0.350
p00	18.52	14.24	9.28	5.359	3.877	5.853	11.65	20.37	29.75
p10	-6.498	-5.013	-3.229	-1.864	-1.539	-2.657	-5.291	-8.813	-11.87
p01	-3.006	-2.042	-0.9369	0.07464	0.8564	1.31	1.498	1.601	2.00
p20	0.7634	0.5884	0.3739	0.2161	0.201	0.3823	0.7658	1.249	1.619
p11	0.6524	0.4615	0.2305	0.02007	-0.1234	-0.1761	-0.1572	-0.1292	-0.221
p02	0.3089	0.2253	0.1306	0.03857	-0.04786	-0.1172	-0.1658	-0.1902	-0.1896
p30	-0.02725	-0.02069	-0.01216	-0.00603	-0.006273	-0.01546	-0.03386	-0.05639	-0.07247
p21	-0.05172	-0.03874	-0.02523	-0.0141	-0.007606	-0.00613	-0.00807	-0.00977	-0.00445
p12	0.003709	0.003999	0.009709	0.01761	0.02503	0.02886	0.02841	0.02586	0.02733
p03	-0.03186	-0.02416	-0.01851	-0.01434	-0.01059	-0.00656	-0.00237	0.000298	-0.0023

$$C_R \cdot 10^3(x,y) = p00 + p10 \cdot x + p01 \cdot y + p20 \cdot x^2 + p11 \cdot x \cdot y + p02 \cdot y^2 + p30 \cdot x^3 + \\ + p21 \cdot x^2 \cdot y + p12 \cdot x \cdot y^2 + p03 \cdot y^3$$

where x and y are $L/V^{1/3}$ and B/T respectively.

The C2054 hull geometry is available for download both in STEP or IGES format and will be sent mailing to: mailto:marcello.costanzo@cnr.it