

Prediction of Resistance and Squat for Bailey's NPL Series Hulls

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Summary

Predictions of resistance and squat are compared to measured values for the NPL series model hulls investigated by Bailey [1].

Introduction

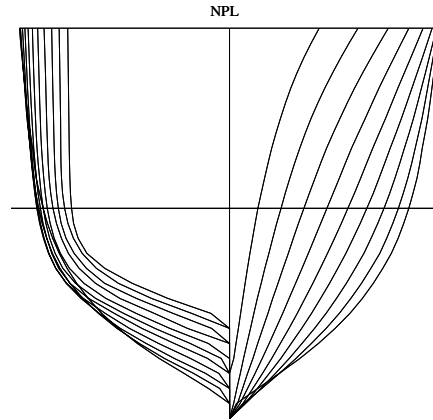


Figure 1: NPL parent hull.

The NPL series of round bilge hulls with transom sterns were first investigated in detail in 1976 by Bailey [1].

Notes

Predictions for the resistance of the very stubby ($L/B = 3.33$) NPL 100D are quite poor for $F > 0.7$.

TODO: Experimental results need to be checked as they were taken from some very poor quality photocopies of graphs.

References

- [1] Bailey, D., “The NPL high speed round bilge displacement hull series”, *Maritime Technology Monograph*, No. 4, RINA, 1976.
- [2] Robards, Simon William, “The hydrodynamics of high-speed transom-stern vessels”, *M. Engineering thesis*, The University of New South Wales, Nov. 2008.

	L (m)	L/B	B/T	C_{∇}	C_B	C_M	C_P	C_{VP}	C_{WP}	S/L^2	B_T/B	T_T/T	C_{AT}
npl50z	2.54	7.51	4.03	8.30	0.396	0.574	0.685	0.523	0.759	0.121	0.820	0.521	0.720
npl50a	2.54	6.25	5.80	8.30	0.396	0.574	0.685	0.523	0.759	0.134	0.820	0.521	0.720
npl80z	2.54	7.51	2.52	7.11	0.396	0.574	0.685	0.523	0.759	0.142	0.820	0.521	0.720
npl80a	2.54	6.25	3.63	7.10	0.396	0.574	0.685	0.523	0.759	0.149	0.820	0.521	0.720
npl80a120	2.54	6.16	3.33	6.67	0.426	0.603	0.698	0.550	0.773	0.160	0.815	0.567	0.761
npl80a140	2.54	6.09	3.09	6.34	0.450	0.628	0.709	0.573	0.785	0.170	0.809	0.603	0.791
npl80a160	2.54	6.03	2.89	6.06	0.471	0.648	0.718	0.592	0.796	0.179	0.803	0.632	0.814
npl80a180	2.54	5.97	2.72	5.83	0.489	0.666	0.727	0.606	0.807	0.188	0.796	0.657	0.832
npl80a200	2.54	5.92	2.57	5.63	0.505	0.680	0.735	0.618	0.817	0.197	0.790	0.679	0.846
npl80a220	2.54	5.87	2.44	5.46	0.520	0.694	0.742	0.627	0.828	0.206	0.786	0.697	0.858
npl80a240	2.54	5.83	2.33	5.30	0.532	0.705	0.749	0.634	0.839	0.215	0.781	0.713	0.867
npl80b	2.54	5.40	4.85	7.09	0.396	0.573	0.685	0.522	0.759	0.161	0.820	0.522	0.720
npl80c	2.54	4.54	6.90	7.11	0.396	0.573	0.685	0.522	0.759	0.181	0.820	0.522	0.720
npl100z	2.54	7.51	2.01	6.58	0.397	0.574	0.685	0.523	0.759	0.159	0.820	0.522	0.721
npl100a80	2.54	6.40	3.17	7.09	0.364	0.542	0.669	0.489	0.743	0.148	0.819	0.465	0.667
npl100a	2.54	6.25	2.90	6.59	0.396	0.574	0.685	0.523	0.759	0.161	0.820	0.521	0.720
npl100a120	2.54	6.16	2.67	6.20	0.425	0.603	0.698	0.550	0.773	0.174	0.815	0.566	0.760
npl100a140	2.54	6.09	2.48	5.88	0.450	0.628	0.709	0.573	0.785	0.185	0.809	0.603	0.791
npl100a160	2.54	6.03	2.31	5.63	0.471	0.648	0.718	0.592	0.796	0.197	0.803	0.632	0.814
npl100a180	2.54	5.97	2.18	5.41	0.489	0.666	0.727	0.606	0.807	0.208	0.796	0.657	0.832
npl100b	2.54	5.40	3.89	6.59	0.396	0.574	0.685	0.523	0.759	0.170	0.820	0.522	0.720
npl100c	2.54	4.55	5.48	6.58	0.396	0.573	0.685	0.522	0.759	0.187	0.820	0.522	0.720
npl100d	2.54	3.33	10.20	6.59	0.396	0.573	0.685	0.522	0.758	0.237	0.820	0.521	0.719
npl150a60	2.54	6.66	2.32	6.82	0.325	0.505	0.643	0.449	0.723	0.155	0.784	0.388	0.603
npl150a80	2.54	6.40	2.11	6.20	0.364	0.542	0.669	0.489	0.743	0.176	0.819	0.465	0.667
npl150a	2.54	6.25	1.93	5.76	0.396	0.574	0.685	0.523	0.759	0.194	0.820	0.521	0.720
npl150a120	2.54	6.16	1.78	5.41	0.426	0.603	0.698	0.550	0.773	0.212	0.815	0.567	0.761
npl150a140	2.54	6.09	1.65	5.14	0.450	0.628	0.709	0.573	0.785	0.230	0.809	0.603	0.791
npl150b	2.54	5.40	2.59	5.75	0.397	0.574	0.685	0.523	0.759	0.196	0.820	0.523	0.721
npl150c	2.54	4.54	3.67	5.75	0.397	0.574	0.685	0.523	0.759	0.206	0.820	0.523	0.721
npl150d	2.54	3.33	6.80	5.76	0.396	0.573	0.685	0.522	0.759	0.247	0.820	0.522	0.719
npl200b	2.54	5.40	1.94	5.23	0.396	0.574	0.685	0.523	0.759	0.225	0.820	0.522	0.720
npl200c	2.54	4.54	2.74	5.23	0.396	0.574	0.685	0.523	0.759	0.227	0.820	0.521	0.720
npl200d	2.54	3.33	5.11	5.23	0.397	0.574	0.685	0.523	0.759	0.259	0.820	0.522	0.721
npl250c	2.54	4.54	2.20	4.86	0.396	0.574	0.685	0.523	0.759	0.251	0.820	0.521	0.720
npl250d	2.54	3.33	4.08	4.85	0.396	0.574	0.685	0.523	0.759	0.272	0.820	0.521	0.720
npl320c	2.54	4.54	1.72	4.47	0.396	0.573	0.685	0.522	0.759	0.287	0.820	0.522	0.720
npl320d	2.54	3.33	3.19	4.47	0.396	0.574	0.685	0.523	0.759	0.294	0.820	0.521	0.720

Table 1: Principal particulars of Bailey's NPL series model hulls.

	x_B/L	z_B/T	x_F/L	$1000I_L/L^4$	$1000I_T/L^4$	$\overline{\text{GM}}_{L0}/L$	$\overline{\text{GM}}_{T0}/B$
npl50z	0.0638	-0.309	0.084	6.74	0.115	3.85	0.420
npl50a	0.0638	-0.309	0.084	8.09	0.200	4.62	0.662
npl80z	0.0638	-0.313	0.084	6.73	0.115	2.40	0.187
npl80a	0.0638	-0.313	0.084	8.09	0.200	2.88	0.361
npl80a120	0.0666	-0.320	0.077	8.40	0.216	2.48	0.299
npl80a140	0.0677	-0.330	0.072	8.65	0.229	2.18	0.248
npl80a160	0.0678	-0.336	0.066	8.89	0.240	1.96	0.207
npl80a180	0.0672	-0.343	0.059	9.13	0.252	1.79	0.173
npl80a200	0.0661	-0.349	0.053	9.38	0.264	1.65	0.143
npl80a220	0.0647	-0.353	0.048	9.64	0.275	1.54	0.118
npl80a240	0.0631	-0.358	0.042	9.92	0.288	1.45	0.096
npl80b	0.0638	-0.310	0.084	9.37	0.310	3.33	0.534
npl80c	0.0638	-0.309	0.084	11.10	0.522	3.99	0.807
npl100z	0.0639	-0.310	0.084	6.74	0.115	1.90	0.094
npl100a80	0.0582	-0.300	0.089	7.71	0.180	2.74	0.316
npl100a	0.0638	-0.309	0.084	8.09	0.200	2.30	0.251
npl100a120	0.0666	-0.320	0.078	8.39	0.216	1.98	0.197
npl100a140	0.0677	-0.330	0.072	8.65	0.229	1.74	0.151
npl100a160	0.0678	-0.336	0.066	8.89	0.240	1.56	0.113
npl100a180	0.0672	-0.343	0.059	9.13	0.252	1.42	0.081
npl100b	0.0638	-0.309	0.084	9.37	0.310	2.66	0.400
npl100c	0.0638	-0.309	0.084	11.10	0.521	3.17	0.619
npl100d	0.0637	-0.313	0.084	15.20	1.320	4.33	1.230
npl150a60	0.0472	-0.294	0.093	7.12	0.151	2.24	0.193
npl150a80	0.0582	-0.300	0.089	7.71	0.180	1.81	0.132
npl150a	0.0638	-0.309	0.084	8.09	0.200	1.52	0.079
npl150a120	0.0666	-0.320	0.077	8.40	0.216	1.30	0.031
npl150a140	0.0677	-0.330	0.072	8.65	0.229	1.14	-0.011
npl150b	0.0639	-0.310	0.084	9.38	0.311	1.76	0.200
npl150c	0.0639	-0.310	0.084	11.20	0.523	2.11	0.368
npl150d	0.0638	-0.310	0.084	15.20	1.320	2.88	0.793
npl200b	0.0638	-0.309	0.084	9.37	0.310	1.31	0.081
npl200c	0.0638	-0.313	0.084	11.10	0.522	1.56	0.224
npl200d	0.0639	-0.310	0.084	15.20	1.320	2.15	0.568
npl250c	0.0638	-0.309	0.084	11.10	0.522	1.25	0.131
npl250d	0.0638	-0.313	0.084	15.20	1.320	1.71	0.426
npl320c	0.0638	-0.310	0.084	11.10	0.522	0.96	0.031
npl320d	0.0638	-0.313	0.084	15.20	1.320	1.33	0.295

Table 2: Principal hydrostatic particulars of Bailey’s NPL series model hulls.

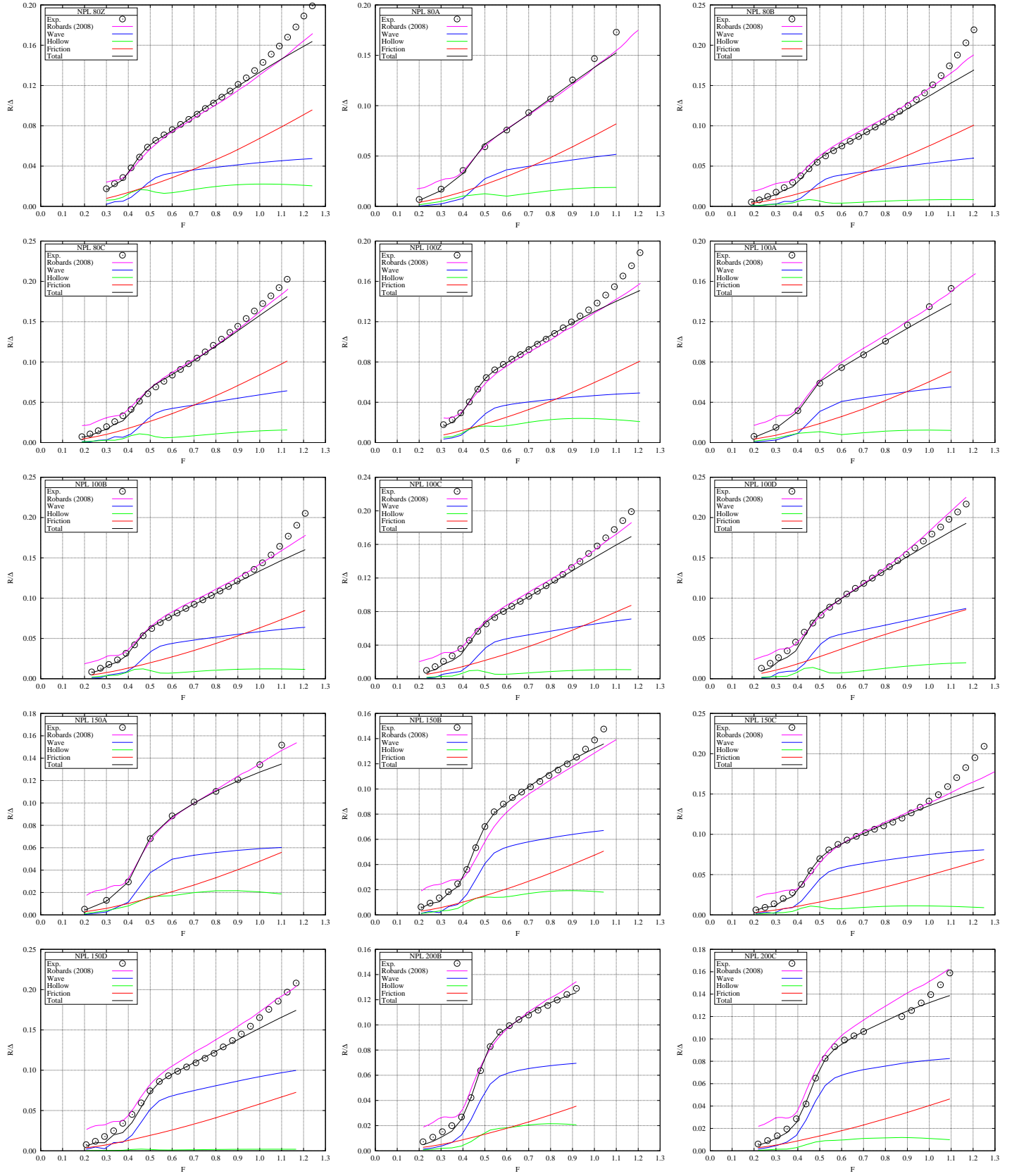


Figure 2: Specific resistance components of Bailey's NPL series model hulls.

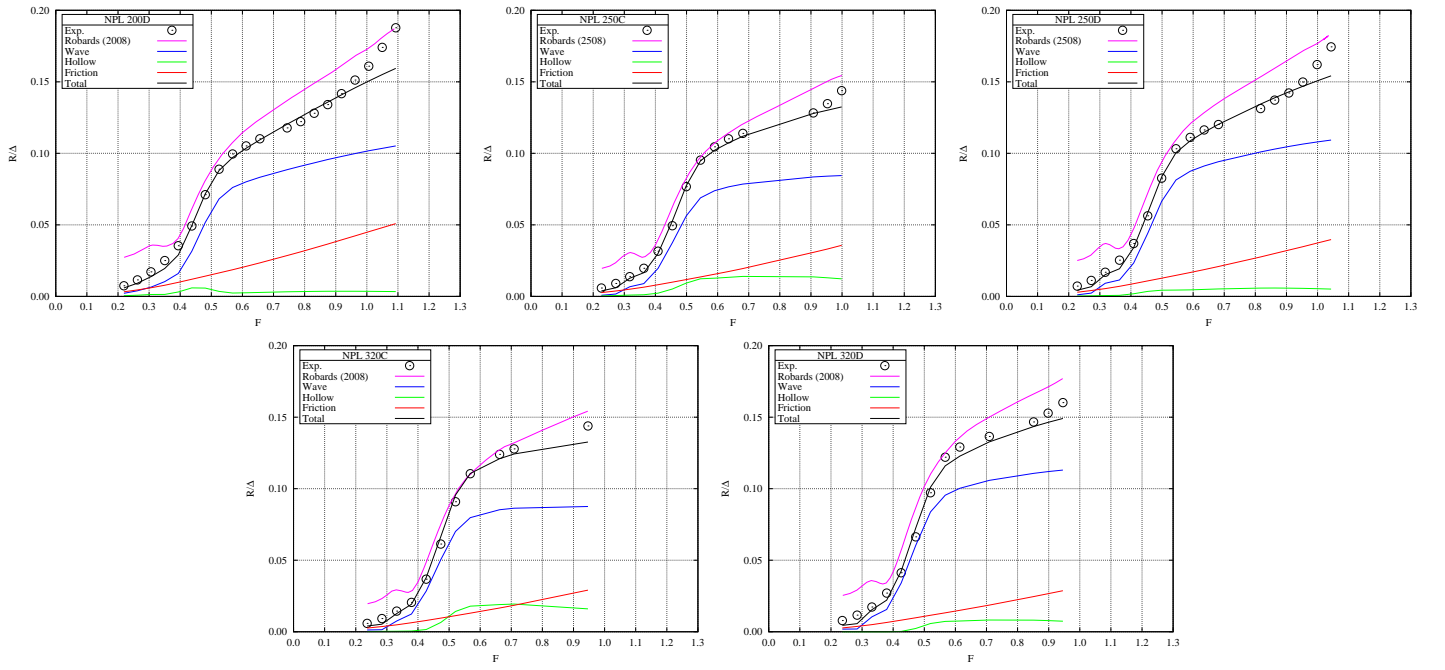


Figure 3: Specific resistance components of Bailey's NPL series hulls.

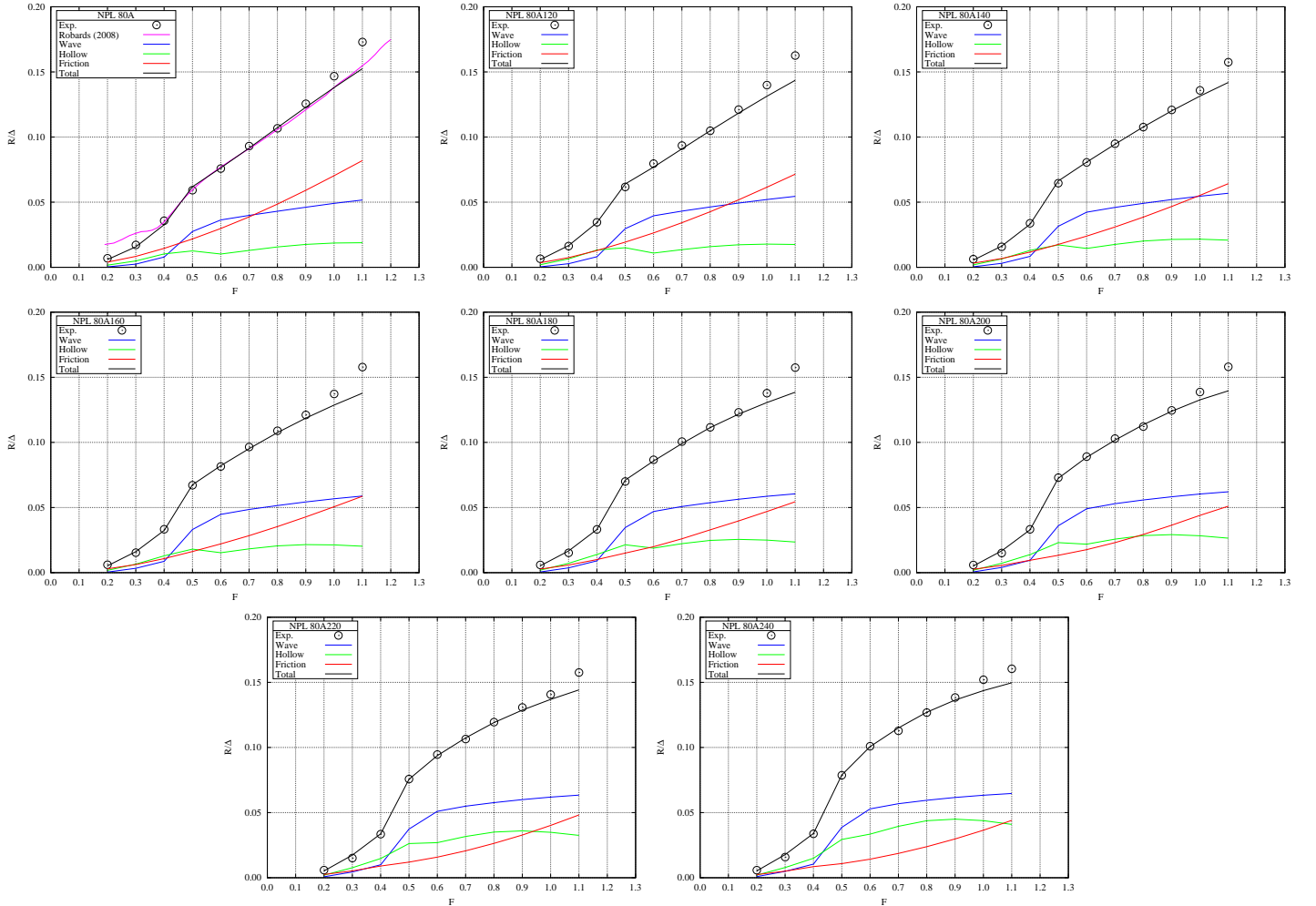


Figure 4: Effect of draft on specific resistance components of Bailey's NPL 80A model hulls.

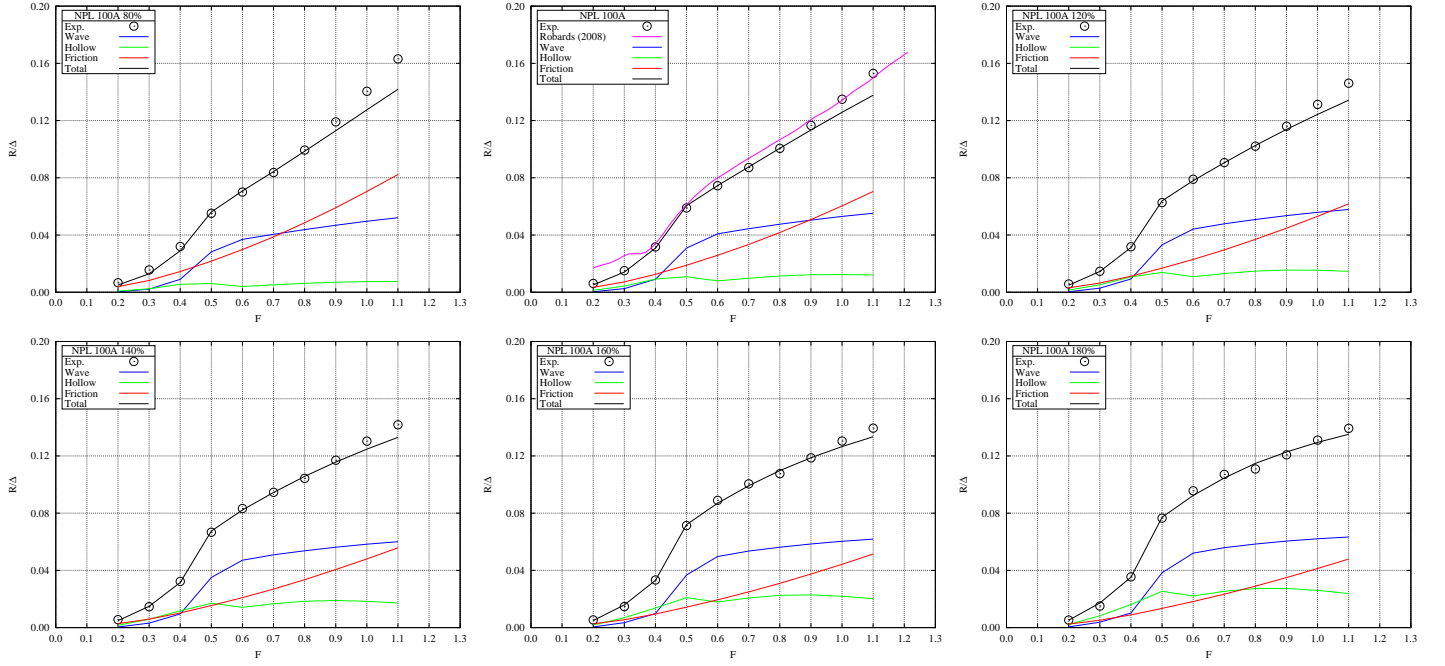


Figure 5: Effect of draft on specific resistance components of Bailey's NPL 100A model hulls.

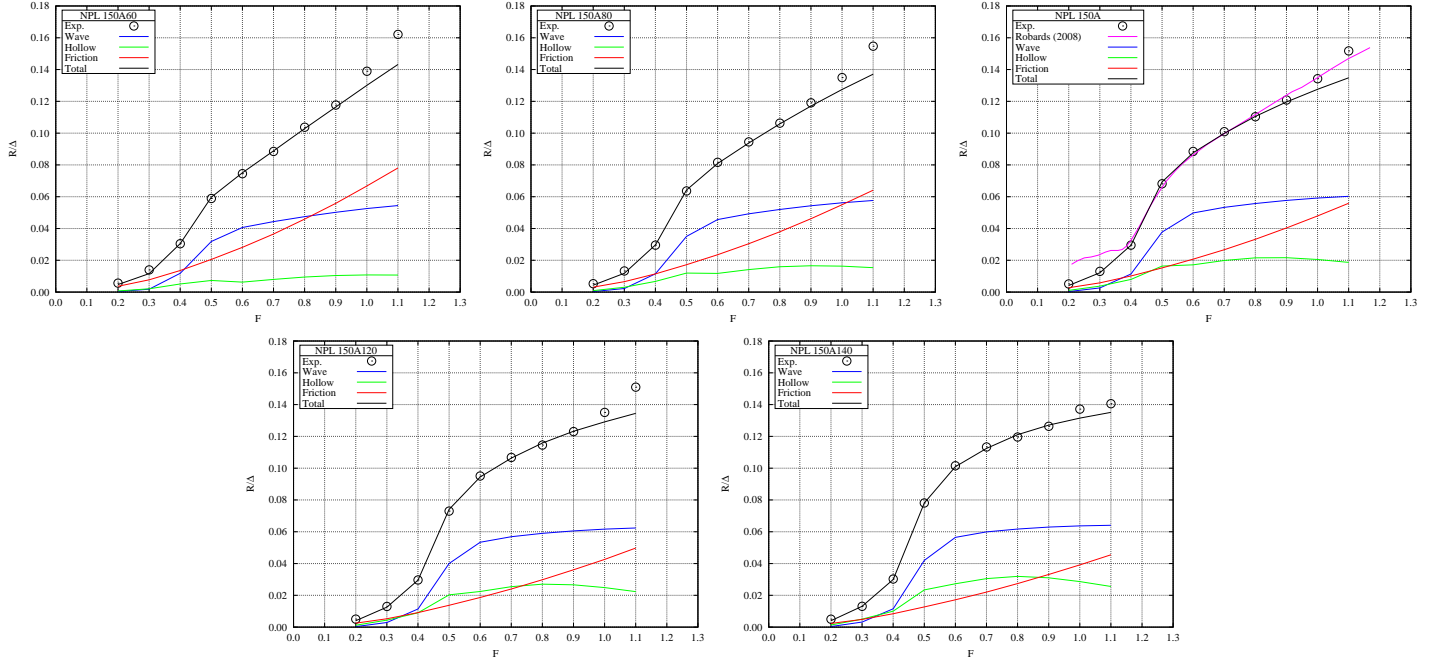


Figure 6: Effect of draft on specific resistance components of Bailey's NPL 150A model hulls.

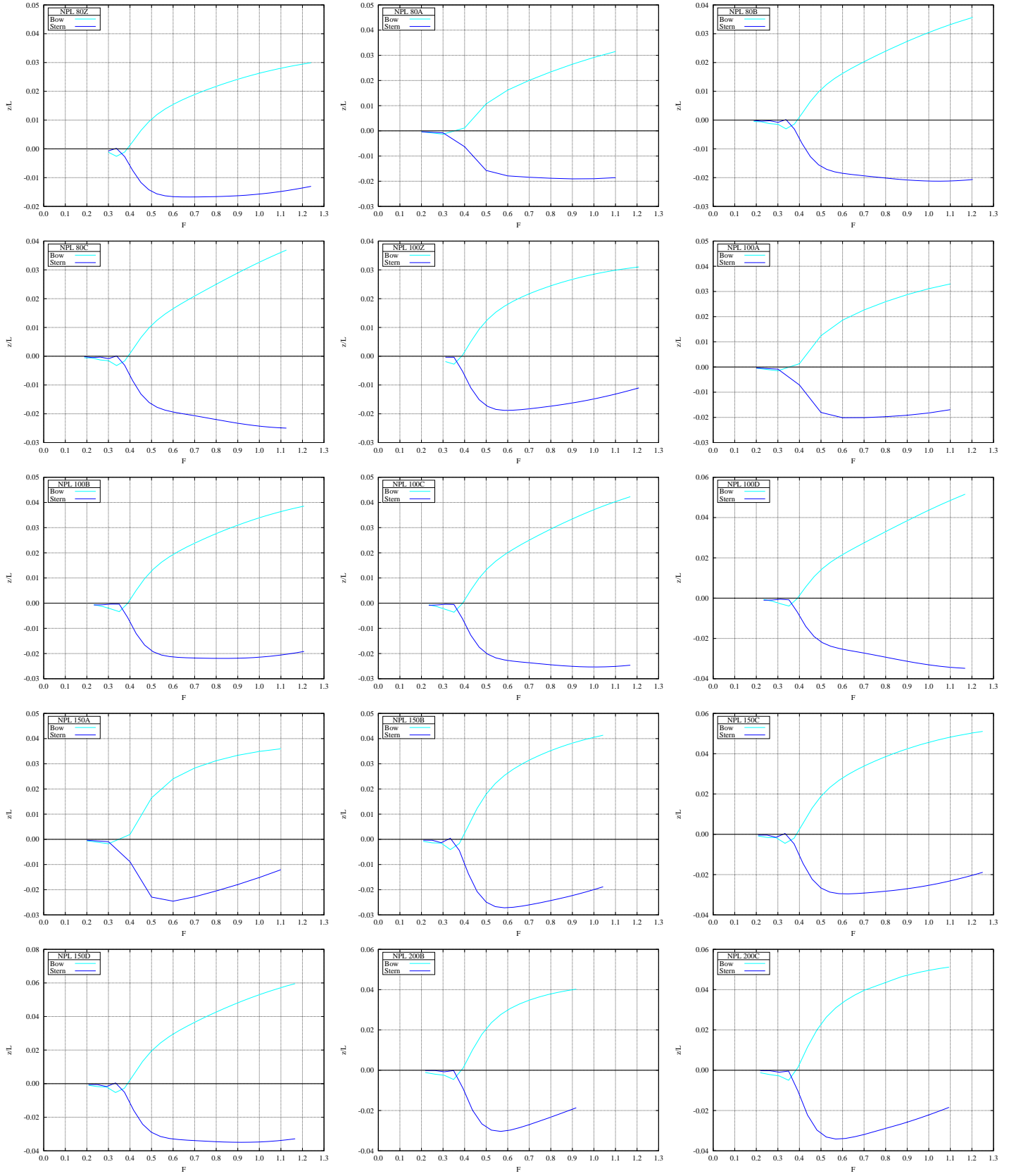


Figure 7: Predicted location of bow and stern of Bailey's NPL series monohulls.

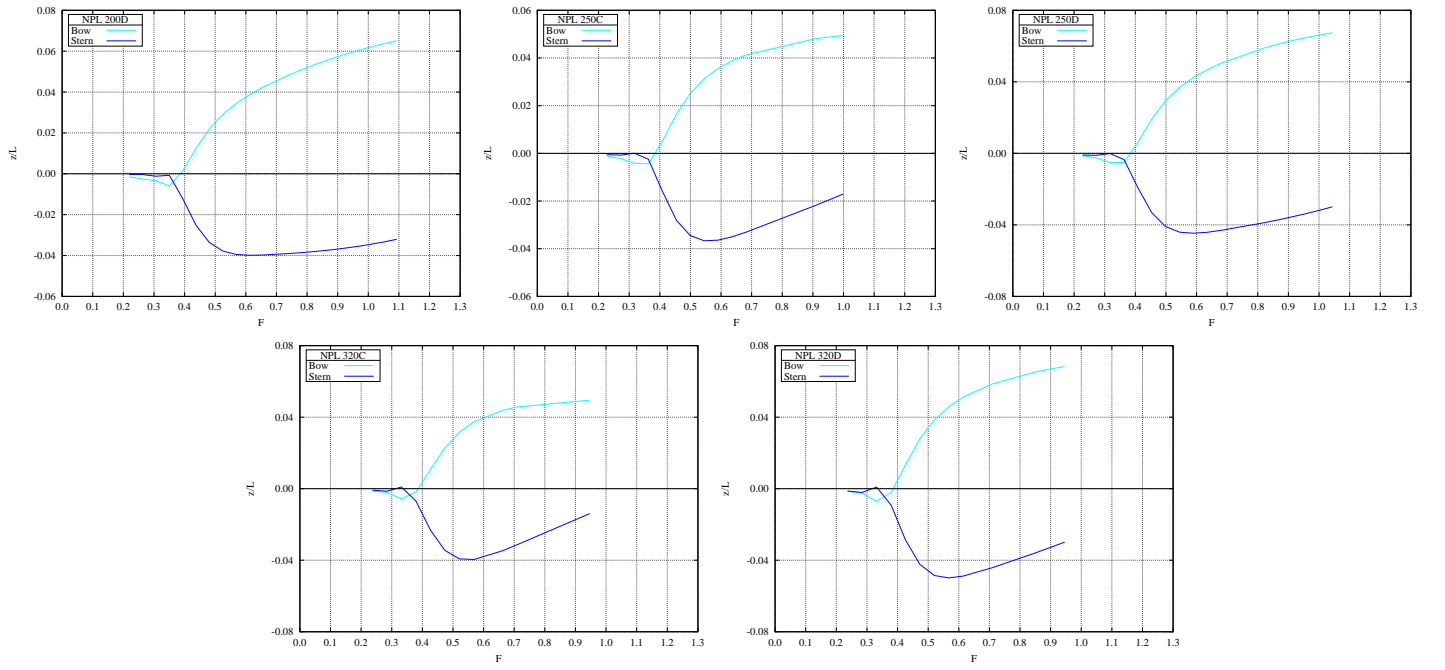


Figure 8: Predicted location of bow and stern of Bailey's NPL series hulls.

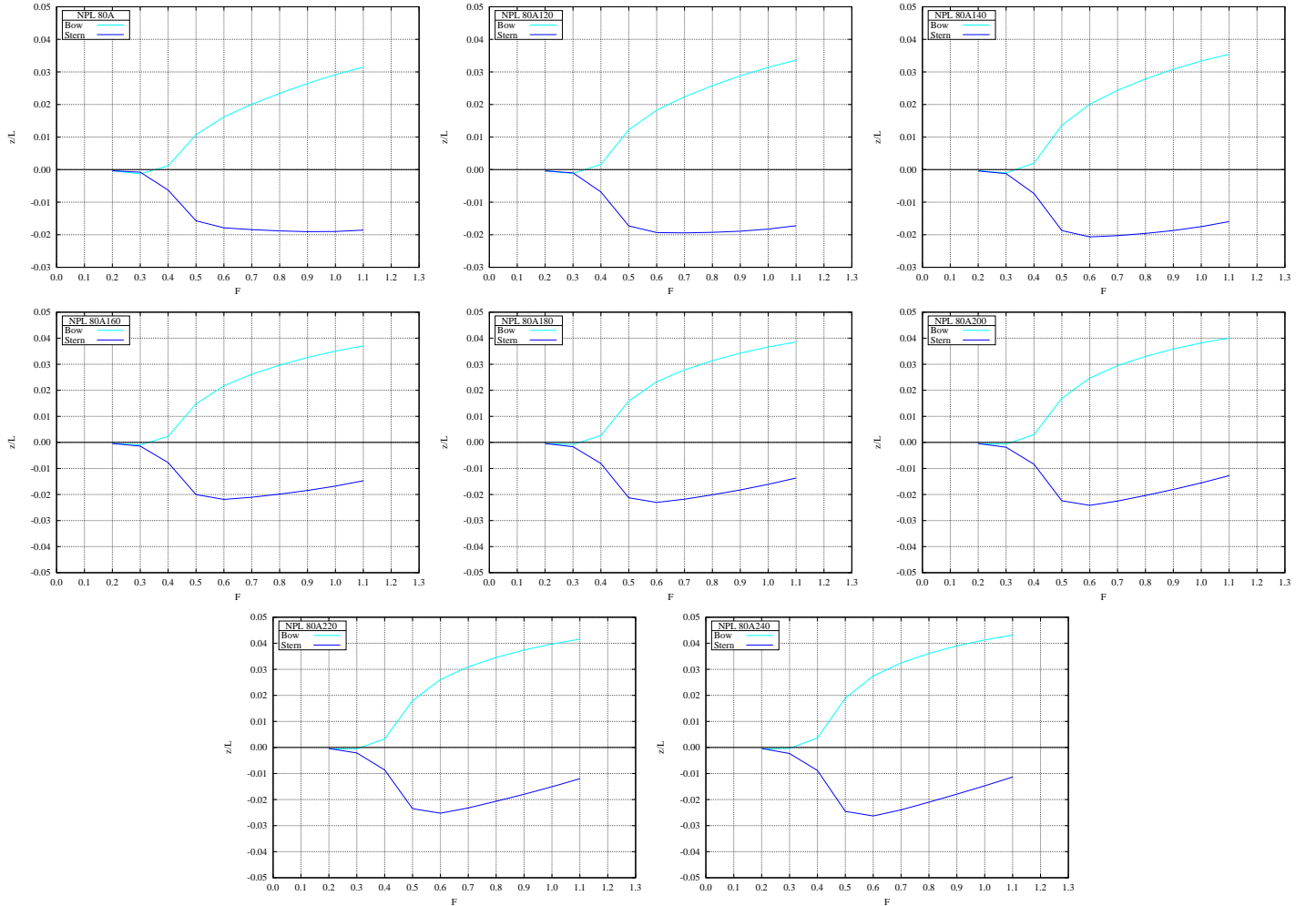


Figure 9: Effect of draft on specific resistance components of Bailey's NPL 80A model hulls.

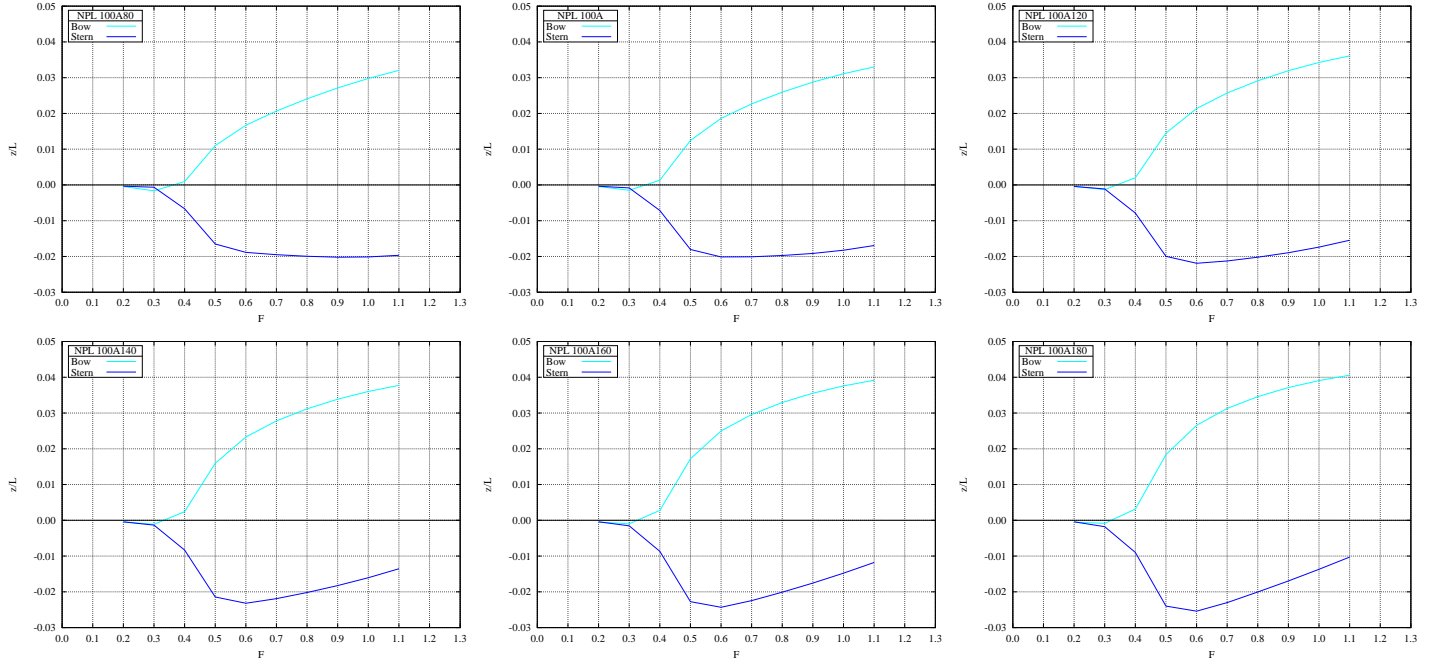


Figure 10: Effect of draft on specific resistance components of Bailey's NPL 100A model hulls.

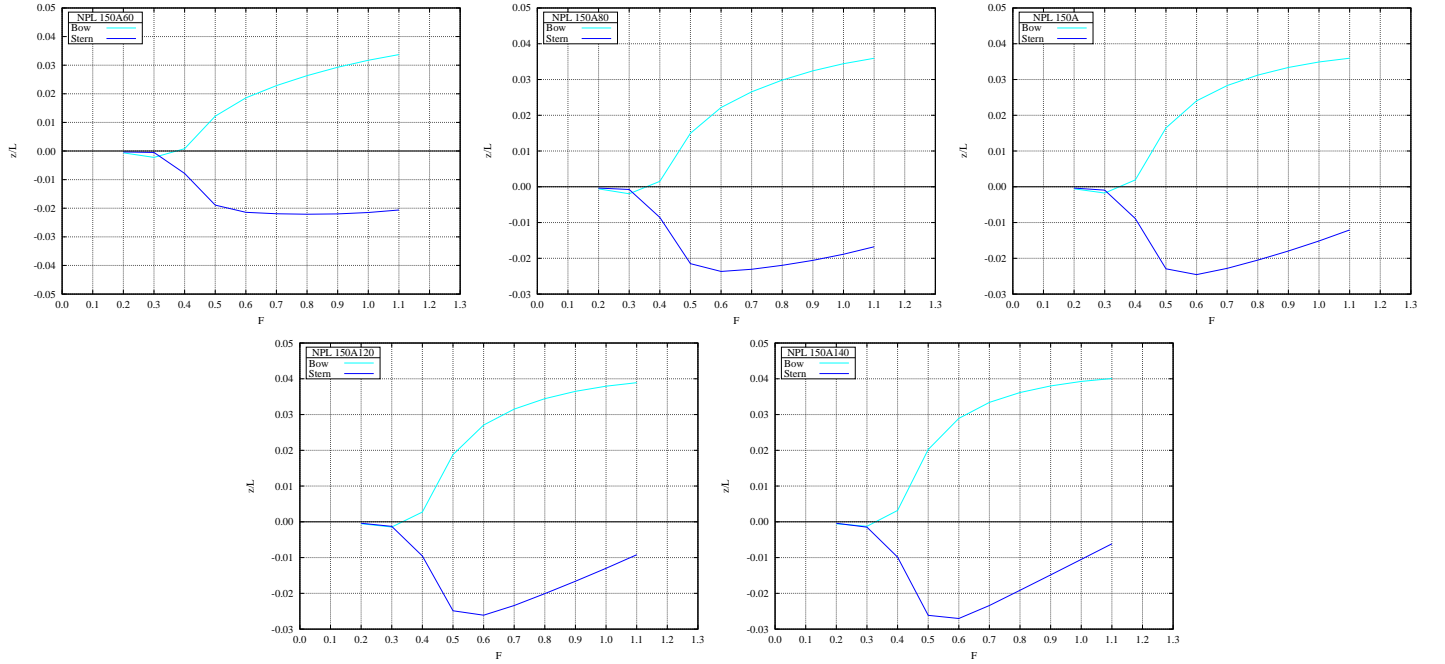


Figure 11: Effect of draft on specific resistance components of Bailey's NPL 150A model hulls.

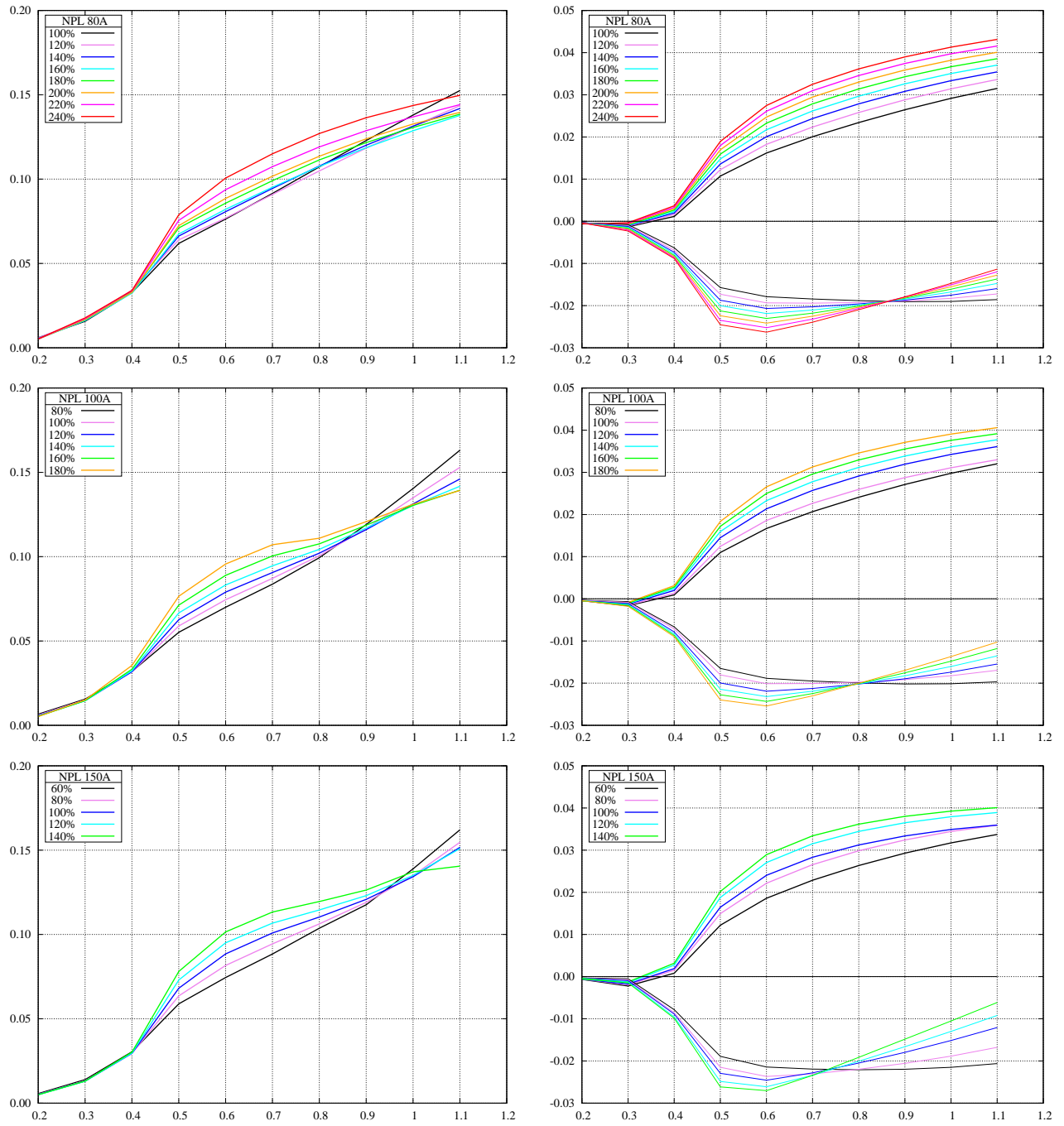


Figure 12: Effect of draft on specific total resistance (left) and squat (right) of Bailey's NPL 80A (top), NPL 100A (middle) and NPL 150A (bottom) model hulls.

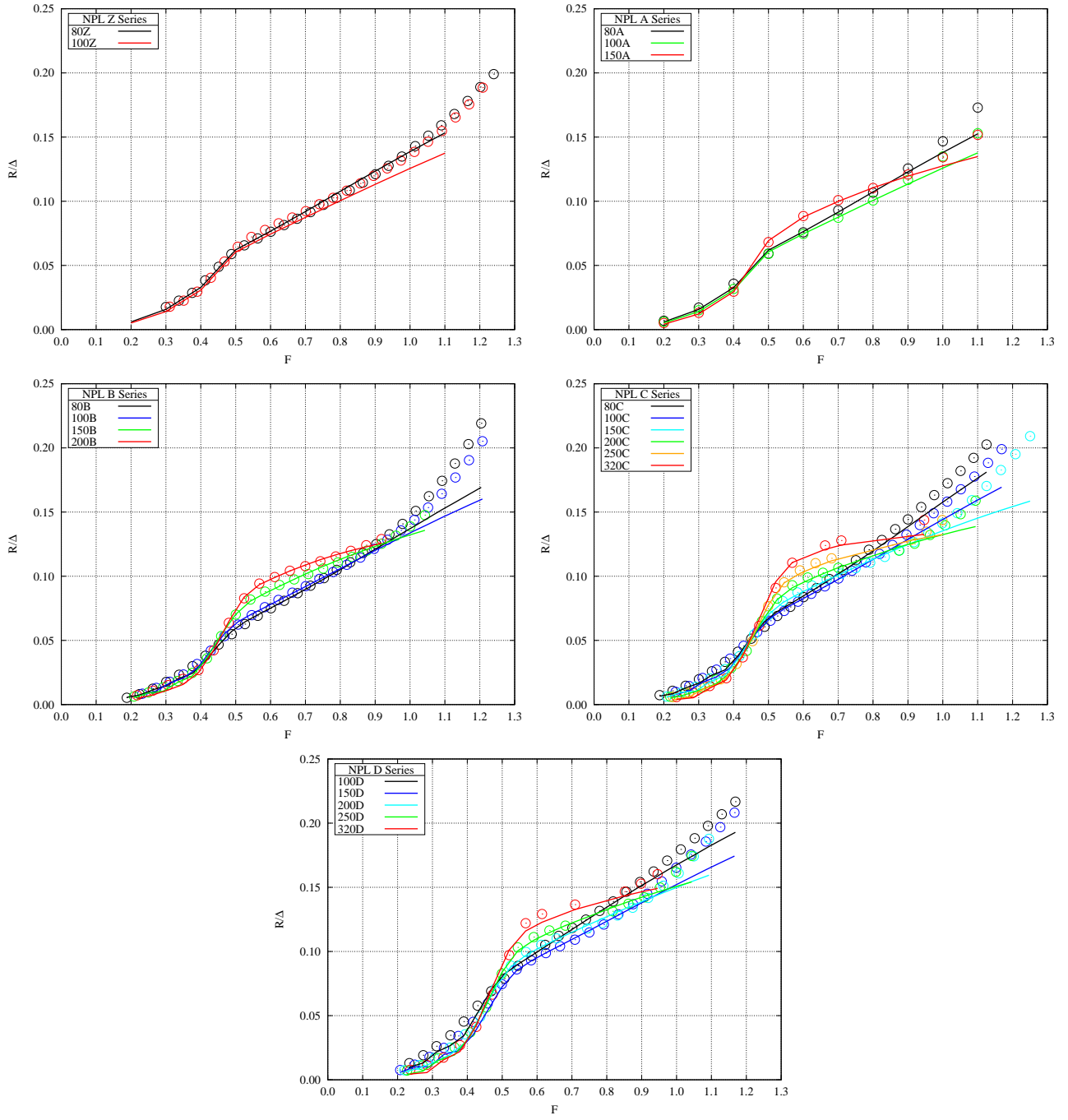


Figure 13: Specific total resistance of Bailey's NPL series: Z (top left), A (top right), B (middle left), C (middle right) and D (bottom).

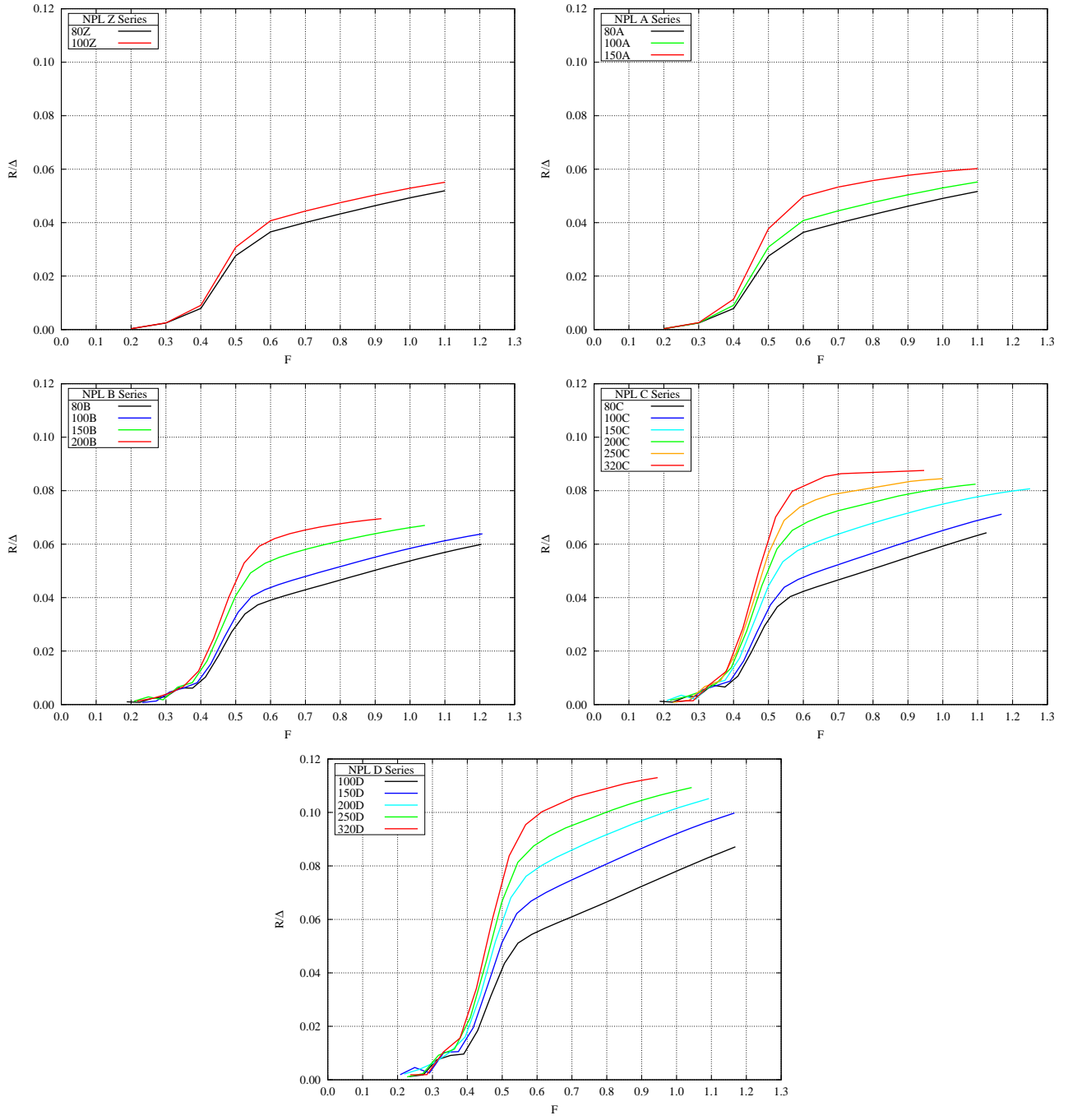


Figure 14: Specific wave resistance of Bailey's NPL series: Z (top left), A (top right), B (middle left), C (middle right) and D (bottom).

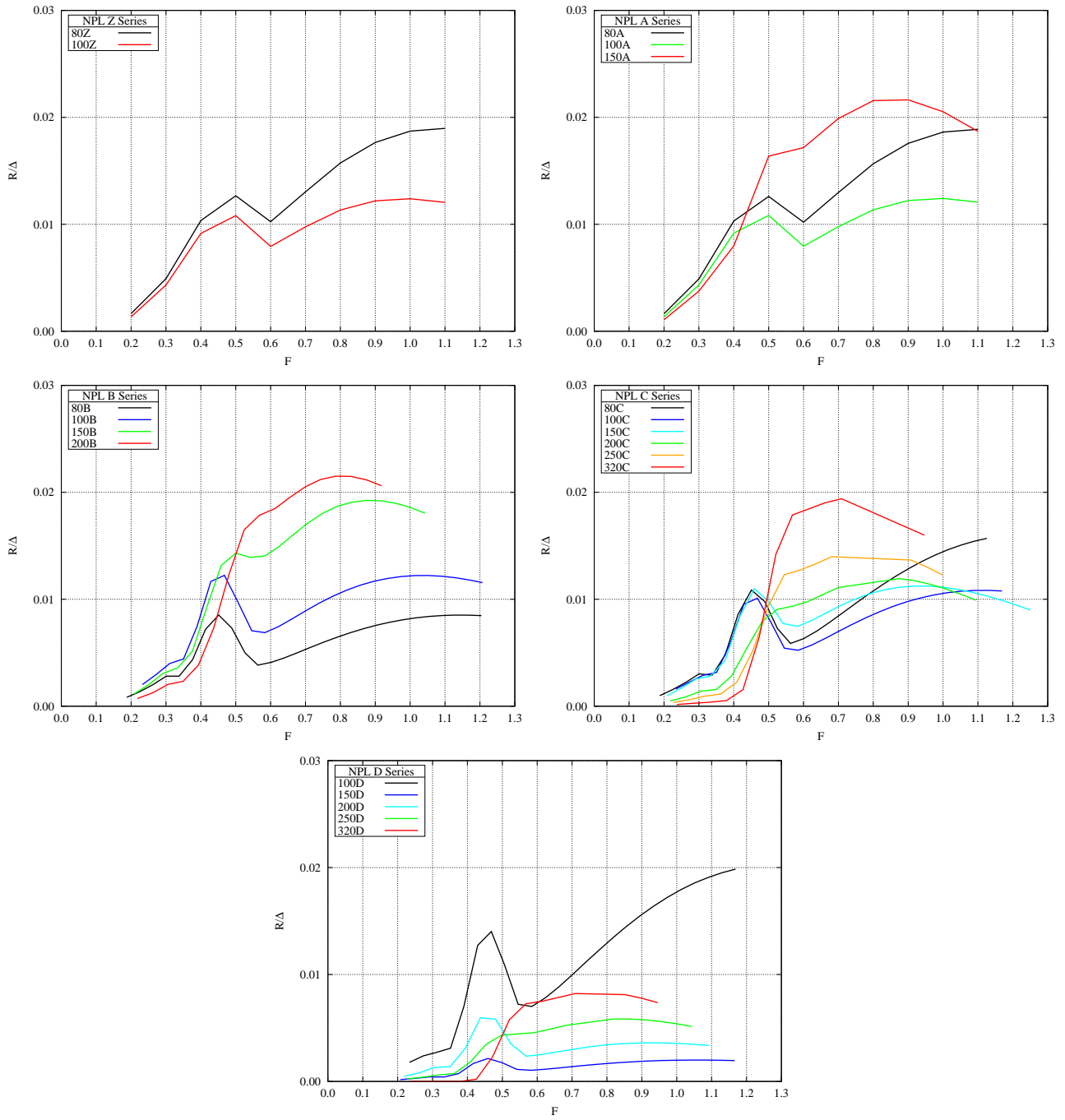


Figure 15: Specific transom hollow resistance of Bailey's NPL series: Z (top left), A (top right), B (middle left), C (middle right) and D (bottom).

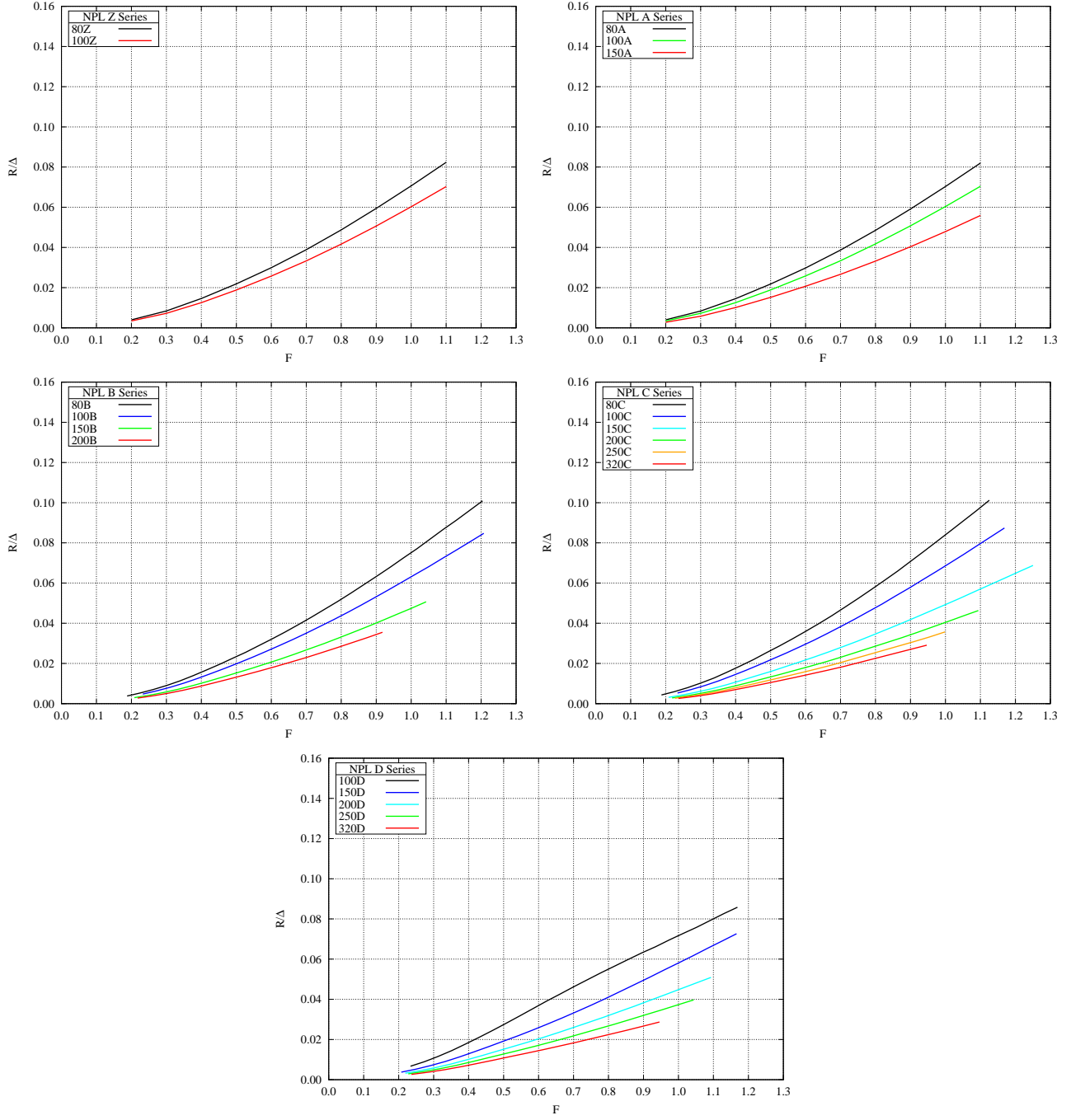


Figure 16: Specific skin-friction of Bailey's NPL series: Z (top left), A (top right), B (middle left), C (middle right) and D (bottom).