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Report

Project:

SYRF Wide-Light Study

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Within this report, results of selected cases from the SYRF wide-light study[1] as computed with the fesShipHydro package for OpenFOAM are presented and discussed. To this end an extract of the wide-light test matrix was created to cover the most typical questions of sailing yacht hydrodynamics, namely resistance curve, effect of heel and yaw sweep:

Case	Fn	Heel	Yaw	xCG	Configuration
[-]	[-]	[deg]	[deg]	[m]	[-]
008	0.45	0.00	0.00	2.367	Bare hull, symmetric
010	0.55	0.00	0.00	2.294	Bare hull, symmetric
012	0.65	0.00	0.00	2.235	Bare hull, symmetric
014	0.75	0.00	0.00	2.172	Bare hull, symmetric
081	0.35	15.00	-2.00	2.431	Fully appended, single rudder
083	0.35	15.00	1.00	2.431	Fully appended, single rudder
085	0.35	15.00	3.00	2.431	Fully appended, single rudder
086	0.50	25.00	-2.00	2.330	Fully appended, single rudder
088	0.50	25.00	1.00	2.330	Fully appended, single rudder
090	0.50	25.00	3.00	2.330	Fully appended, single rudder

All cases were run using a fully automated setup to ensure consistency. For the symmetrical bare hull cases a mesh of about 2.2 mio. cells was generated using snappyHexMesh with some additional scripting, for the fully appended heeled cases meshes of about 5.6 mio. cells. Runtime was about 6h for the bare hull cases, and 14h for the fully appended, both on a dual XEON E5-2650 (2.0GHz) workstation. For these computations the fesShipHydro package was used in conjunction with OF3.0.1.

The results are compared to those from the experiments as well as those computed with Fine|Marine and Star-CCM+.

In the following figures the results from the simulations run using the fesShipHydro package are shown an compared to experimental data as well as those computed using commercial solvers. As can clearly be seen the forces obtained using the fesShipHydro package fit in very well with those obtained from the commercial codes. The accuracy for trim and heave is in the same range as for the commercial codes.

Trial runs using the fesShipHydro package in conjunction with OF4.1 show the same results.

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[1] Claughton, A.R.: *SYRF Wide-Light Project*, Sailing Yacht Research Foundation, 2015, http://sailyachtresearch.org/projects/wide-light-project
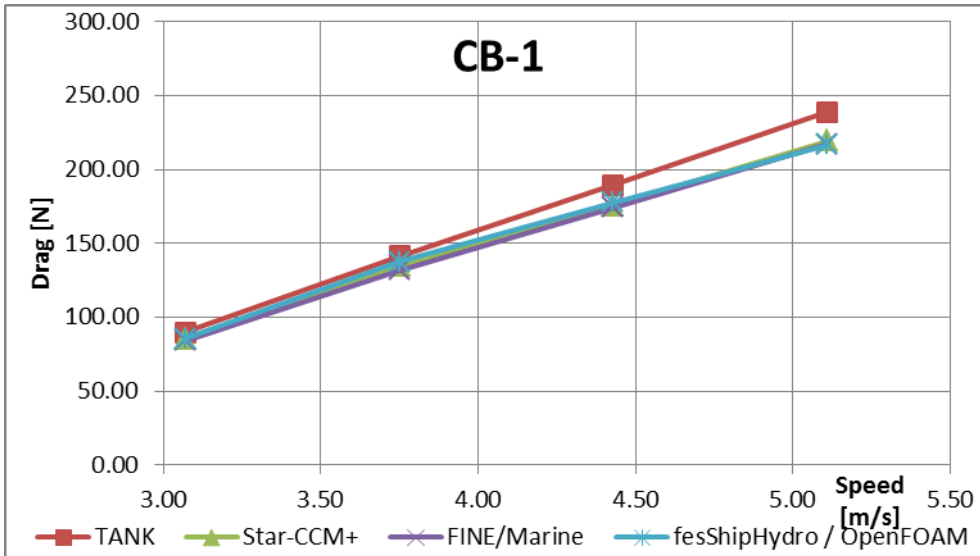
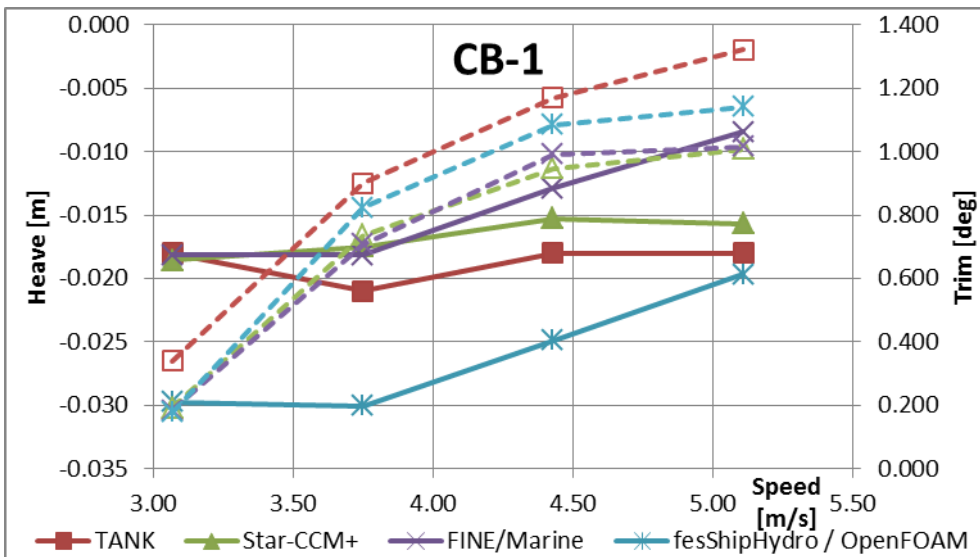**Figure 1: Resistance curves bare hull upright**

Figure 2: Trim (dashed) and heave (solid) bare hull upright
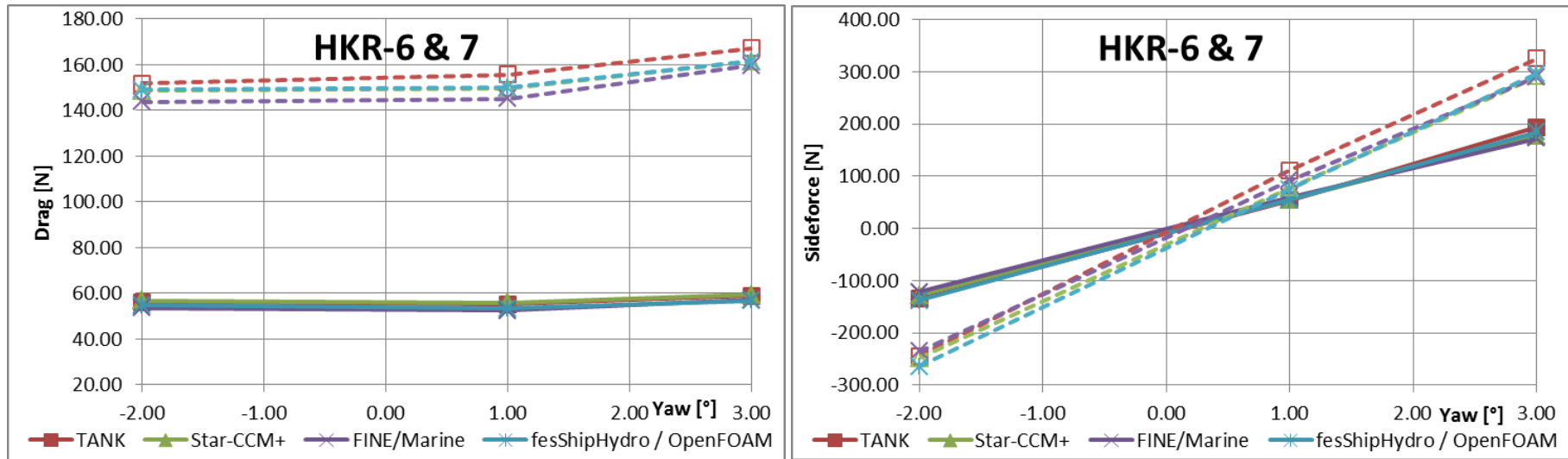
Figure 3: Resistance and sideforce as functions of yaw at Fn 0.35, 15° heel (solid) and Fn 0.55, 25° heel (dashed)

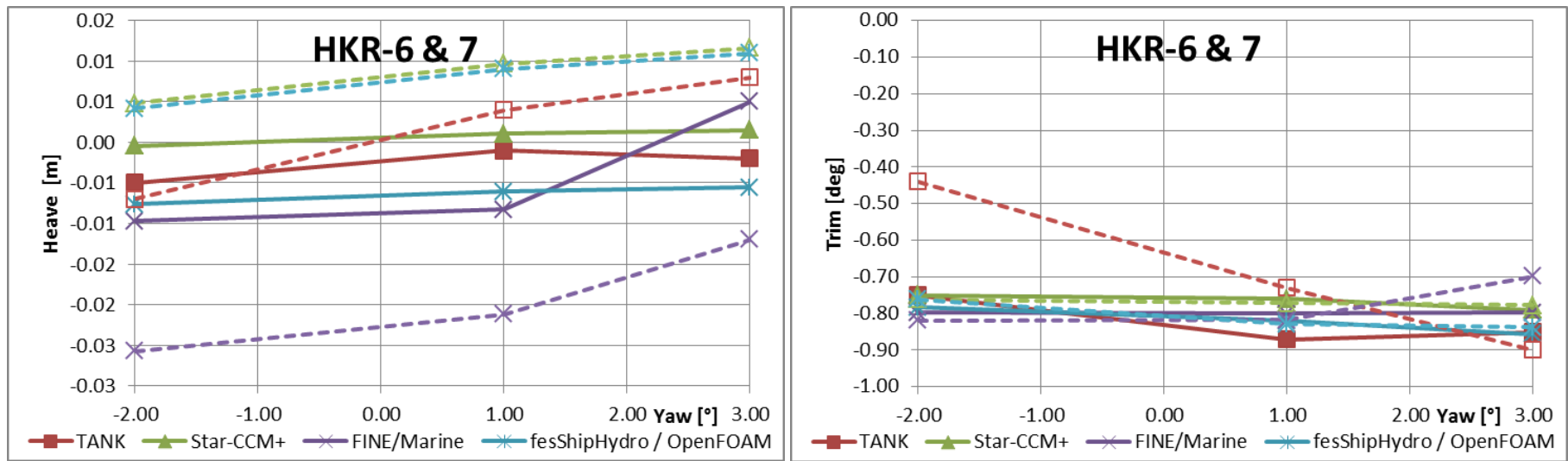**Figure 4:Heave and trim as functions of yaw at Fn 0.35, 15° heel (solid) and Fn 0.55, 25° heel (dashed)**
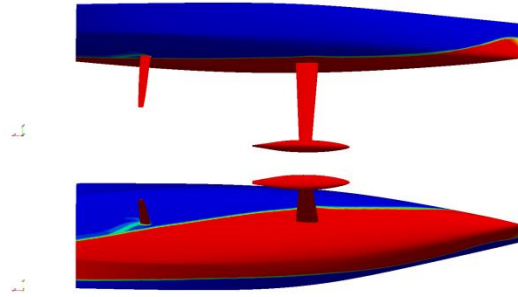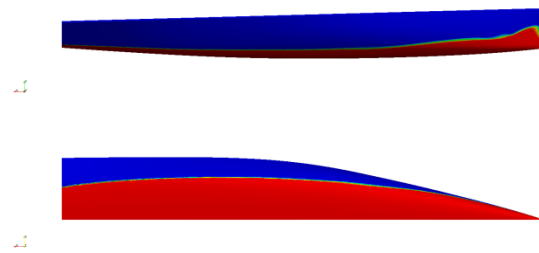
FluidEngineeringSolutions GmbH & Co. KG, Metzstr. 12, 24116 Kiel, Germany
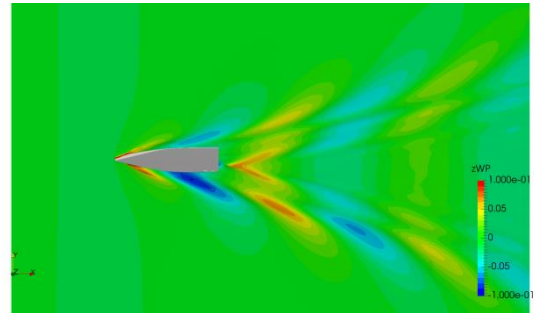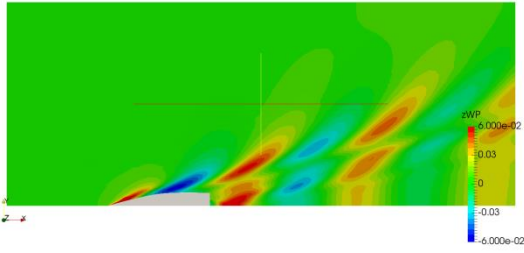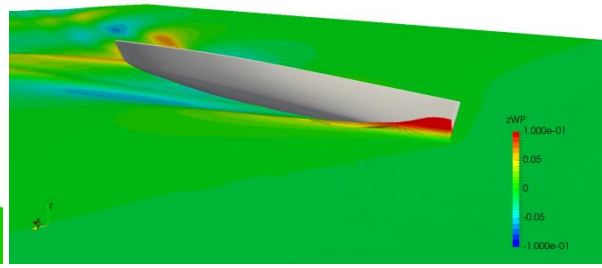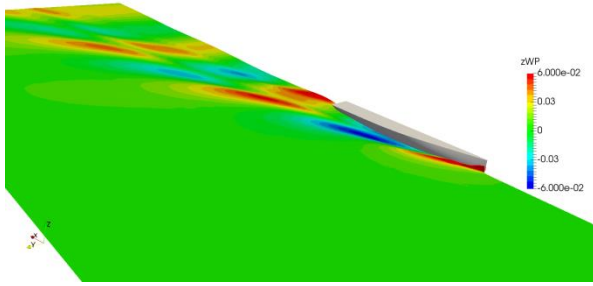
Figure 5:Wave pattern at Fn 0.45

Figure 6: Wave pattern at Fn 0.50, 25° heel, -2° yaw