Shape Optimization of Free-Floating Vessels

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ABSTRACT

Resistance optimization is essential in naval architecture due to increasing demands on the fuel efficiency of merchant ships for economic and environmental reasons. When attention is directed to optimal shape design, the adjoint method is the most efficient approach since the optimization effort does not scale with the number of design variables. However, vessels are subjected to a change of floatation in response to an optimization-driven change of the hull force (distribution). The latter directly hints on a possible deficit of the frequently employed frozen floatation approach, as predicted resistance changes can considerably deviate from actually achieved changes due to a change of the unconsidered floatation.

In this presentation, the influence of floating position during optimization will be presented. For this purpose the optimization-loop, that is tailored around the primal/dual RANS solver FreSCo$^+$ [1, 2], is augmented by a 6-DoF quaternion solver [3], to calculate the equilibrium floating position. It will be demonstrated that the optimization path hinges on the floating position. Results included will address optimizations with and without taking into account a change of the floating position and reveal the benefit of considering floatation during the optimization procedure (see Fig. 1).

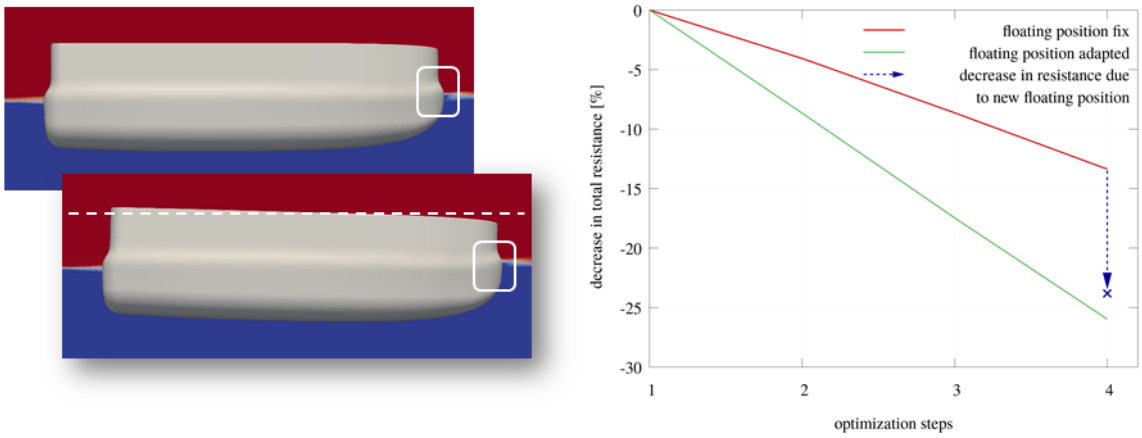

Figure 1: Comparison of frozen and free floating shape optimization with respect to resistance.

REFERENCES

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