

SAILING AND YACHT ENGINEERING

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ABSTRACT

Sailing yachts and particularly high-performance sailing propose interesting challenges to scientists, engineers and designers. Moreover, the science of sailing is now given a new sector of application in the field of marine transport as wind-assistance is increasingly considered to help decarbonize shipping. Designing and predicting the performance of a sailing yacht requires understanding in several areas of mechanics.

The flow over sails is characterized by a strong fluid structure interaction as the structure is more or less compliant and very light. The problem can now be correctly simulated in the steady state, thanks to coupled CFD and FEA analyses, but this demands high computational efforts and is reserved to high-end projects. Real-life sailing is however often subject to unsteadiness because of wind variations, waves, or dynamic actions from the crew. The sails' forces are then dominated by dynamic effects where the fluid added mass is often key, with significant structural deformations, flow separations, vortices etc.

For the yacht hydrodynamics, the complexity related to a small craft in waves is even pushed further by the particular features of the sail propulsion: e.g. heeling and pitching moments, leeway and necessity to generate a side force, aero/hydro dynamic coupling ... Modern high-performance yachts are fitted with foils to lift the yacht out of the water and reduce resistance. These high-lift surfaces bring new issues as for example big problems of stability and control.

Finally, the structural engineering of yachts is challenging, to design and manufacture structures in high-performance composites, submitted to harsh environment and severe loading conditions, to find the best compromise between performance and robustness.

This session is aimed at sharing works, experiences and views about the different aspects of yacht engineering, from fluid or solid mechanics to performance prediction or any topic related to the science of sailing and wind-assisted ships. Contributions are equally invited on modelling, simulation techniques and results, experiments, theory, or industrial design practices.