

# SOPHYA: SEAKEEPING OF PLANING HULL YACHTS

*An experimentally validated computational pipeline for the seakeeping design of planing hulls*

H2020 SOCIETAL CHALLENGES: Smart, Green and integrated transport

PRODUCTIVE SECTOR: Mechanics and Mechatronics

## PROBLEM DESCRIPTION

MCY is among the leading Italian producer leisure yachts. The main goal is to improve the seakindness and comfort of the planing hulls in non calm sea conditions.

## CHALLENGES AND GOALS

- Develop and validate new simulation tools for planing yachts also accounting for non calm sea conditions;
- Obtain a parametric formulation of the original shape
- Develop model order reduction techniques for fast and reliable optimization campaigns.

## MATHEMATICAL AND COMPUTATIONAL METHODS

Many components of the optimization algorithm of a planing hull yachts have been developed in the project:

- The hull geometry is deformed with a specifically developed shape parameterization strategy in which the mesh for the CFD simulations is modified along with the CAD geometry of the hull;
- The full order model based on finite volume approach allows to simulate the turbulent flow and consider the rigid hull motions in non calm conditions. High-fidelity solution are collected into a database;
- Proper orthogonal decomposition with interpolation is applied to efficiently compute the solution of a parametric partial differential equations system, exploiting the precomputed solutions database.

A rendering of the CFD simulation results superimposed to the actual wave pattern past a yacht advancing in non calm sea conditions



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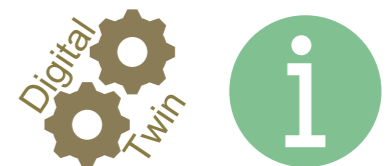
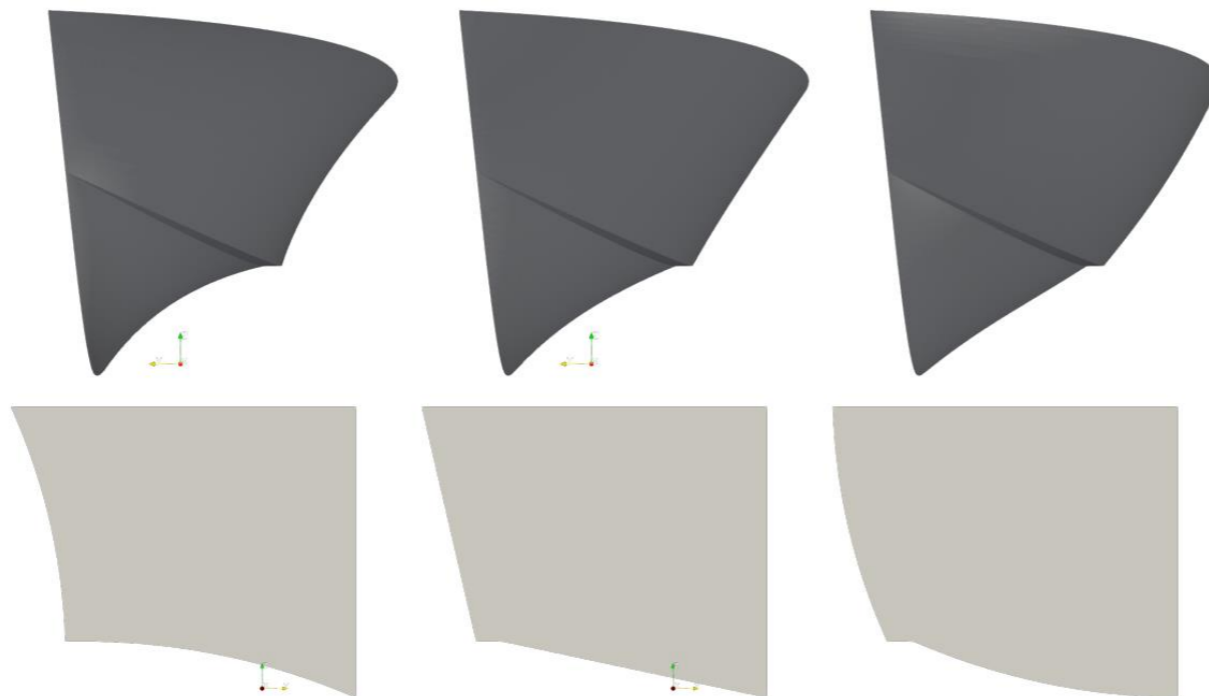
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## Results and Benefits

The experimental effort of the project results in validated simulation tools. The full optimization pipeline composed by shape parameterization, full order simulation and model reduction tools has been put to test to generate a new, optimized hull. After further validation through towing tank tests, the optimized hull will be put in production by MCY

The company now has a new efficient design pipeline to develop hulls with increased comfort. A first optimized hull will be soon entering the market

Front (top) and rear (bottom) view of hull deformations obtained modifying the surface curvature



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