

Computing ship-propeller interaction with CFX-TASCflow

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 The frozen rotor capability of CFX-TASCflow allows topologically different grids to be connected. 

THE GOAL of a joint project between SVA (Schiffsbau Versuchsanstalt) Potsdam GmbH and AEA Technology GmbH is to predict the interaction between the hull of a ship and its propeller. The 4-year project, which is sponsored by the Bundesministerium für Bildung, Wissenschaft, Forschung und Technologies, aims to compute the unsteady flow past the propeller as it rotates behind the ship.

The computations have been performed using CFX-TASCflow which, with its advanced rotor-stator capabilities, is well suited to these types of flows. To date, computations have been performed in a steady-state mode, based on the assumption of quasi-steady flow around the propeller at every rotation angle. CFX-TASCflow's frozen rotor capability is employed with the rotating propeller grid linked to the hull grid via an unmatched interface. This feature allows topologically different grids to be connected, and makes the generation of high quality meshes in the two regions much easier.

The complete grid consists of 140 blocks and 392,370 cells covering the five blades of the propeller and the ship. The computations benefit greatly from CFX-TASCflow's coupled algebraic multigrid (AMG) solver, which ensures fast convergence even for rotating flow domains and problems with strong source terms.

Figure 1 shows streaklines originating from upstream locations and passing through the propeller region. The swirl introduced by the propeller is clearly visible. Figure 2 shows the pressure distribution on the hull and the propeller. The presence of the ship hull is apparent from the different pressure distributions on each blade.

The next step in the project is to apply a prototype implementation of an unsteady rotor-stator interface in CFX-TASCflow to the same geometry. Among other things, this will allow the validity of the currently-adopted frozen rotor assumption to be assessed.

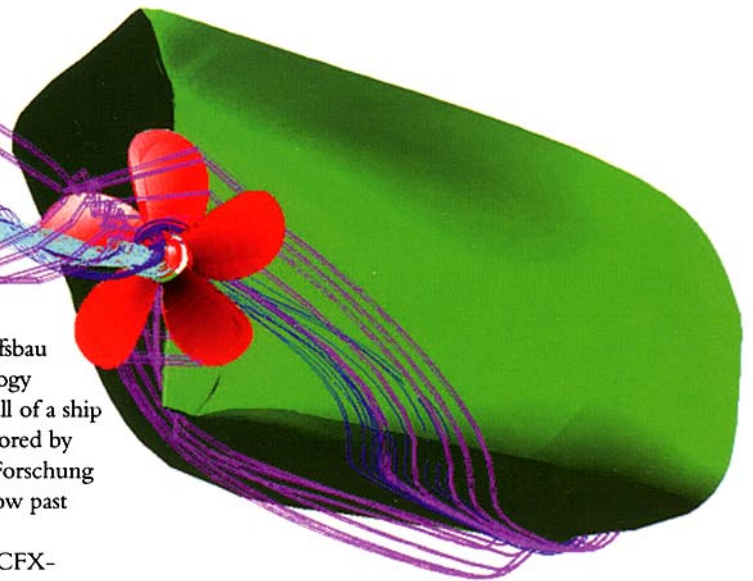


Figure 1: Streaklines originating from upstream locations

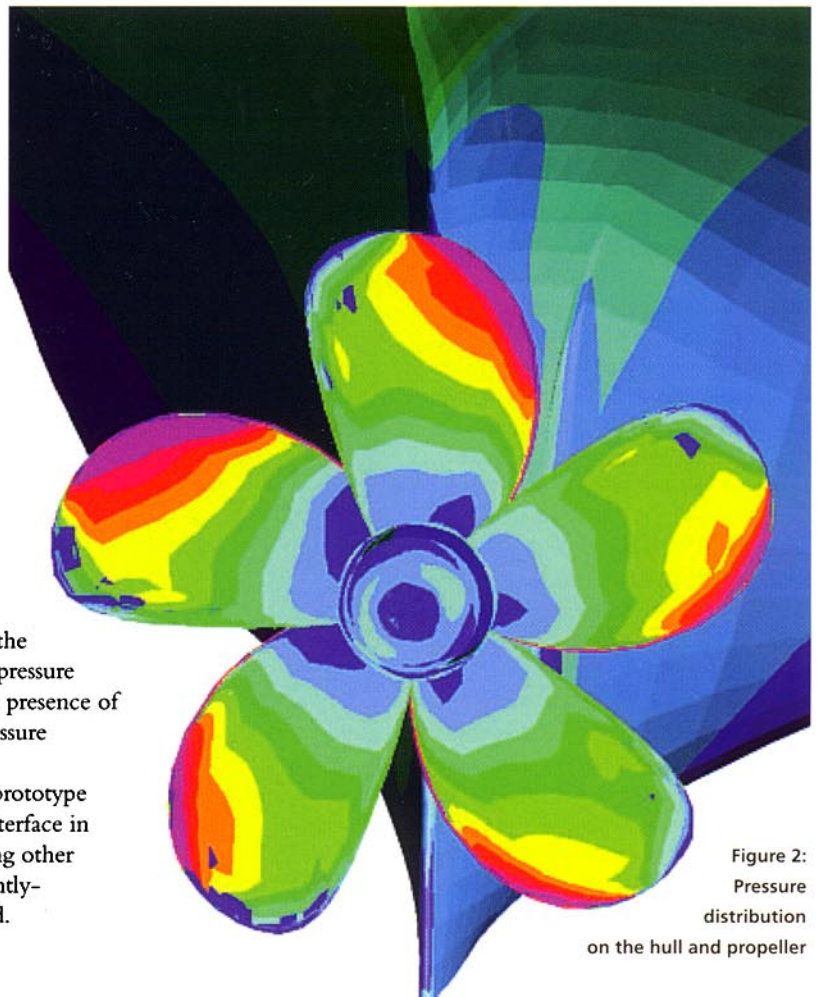


Figure 2: Pressure distribution on the hull and propeller

