XI International Conference on Computational Methods in Marine Engineering

Comparison of different rotor sails configuration into large ore carriers navigation performance

Felipe Ruggeri[1*], Claudio Mueller Prado Sampaio[2], Heinz Bill Galdos Lindao [2], Mariana Lopes Pinto[3] and Philip von Pritzelwitz [3]

[1] Argonautica Engineering & Research, São Paulo, Brazil

[2] Numerical Offshore Tank, University of São Paulo, São Paulo, Brazil.

[3] Vale Institute of Technology (ITV), Ouro Preto, Brazil

[*] Corresponding. ruggeri@argonautica.com.br .

ABSTRACT

The reduction of CO2, NOx, and SOx emissions has become important in recent years for the maritime industry, with various technologies being applied to different vessels, of which rotor sails have been one of the most successful recently. However, when several of these devices are installed on a vessel, constructive and destructive interaction effects arise due to the wakes generated by the vessel and the devices themselves in the inflow of another rotor sail, changing the performance significantly from the experimental predictions of a single rotor alone or by simplified formulations/regressions. This study presents a comparative analysis of different positioning alternatives for rotor sails on large ore carriers, aiming to verify the performance variations considering the expected wind conditions on the route between Brazil and China in laden and ballast conditions. The behavior of the rotor sails was studied applying computational fluid dynamics, which provides the thrust produced in the direction of advance per device, allowing to identify the increase and reduction of performance due to the interaction with other devices or the ship hull, as well as the torques generated during rotation, which are used to calculate the energy required for the operation of the device. A simulation tool was developed to combine the different rotor sails configurations with the wind conditions found during the complete navigation cycle, which is evaluated using a statistical approach considering the 40 years of modelled conditions to provide the best alternative. Since the vessel speed also changes the relative wind condition, thus the rotor sails performance, a sensitivness analysis was performed to verify the robustness of the solutions.

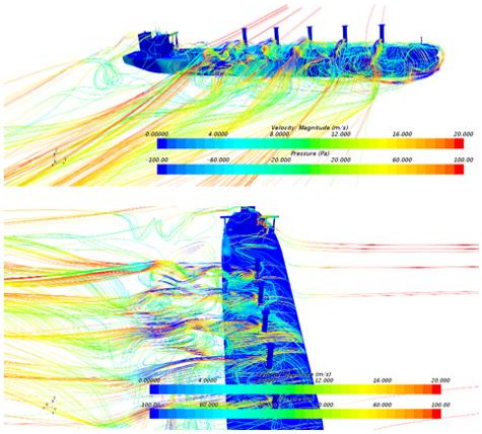

Figure 1: Streamline of rotor sails.