Dynamics of Propeller Blade and Duct Loading on Ventilated Thrusters in Dynamic Positioning Mode

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Abstract

In order to obtain insight into the dynamics of propeller blade and duct loading fluctuations and ventilation phenomenon of thrusters in dynamic positioning (DP) mode, dynamic model tests of a ducted pushing thruster and an open pulling thruster were performed. Tests are performed under both constant immersions and with forced sinusoidal heave motion at bollard condition.

High-speed cameras were used to visualize the ventilation phenomena. A high sampling frequency was employed for measurements, and wireless transmission was used to minimize data transfer noise. The objective of the study was to help to understand the dynamics of forces which in turn can improve the design of mechanical components for realistic loads and possibly avoid the most harmful operating conditions. In addition test results deliver crucial information required for better management of different DP scenarios in the event of thruster ventilation/aeration. The test set up is described briefly.

Measurements of the single blade axial force (blade thrust) and single blade moment about the propeller shaft (corresponding to propeller torque) as well as duct thrust and total thrust of thrusters, together with photographs of ventilated propellers at different submersion positions, are presented and discussed. Hydrodynamic characteristics of ducted thrusters are compared with those of open thrusters. Findings in this paper are – to some extent – also valid to podded propulsion units.

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