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Andrei Tsarau, Raed Lubbad, Sveinung Løset

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A numerical model for simulating the effect of propeller flow in ice management

Andrei Tsarau*[1)], Raed Lubbad and Sveinung Løset [1)]

[1)] *Sustainable Arctic Marine and Coastal Technology (SAMCoT), Centre for Research-based Innovation (CRI), Norwegian University of Science and Technology, Trondheim, Norway.*

**andrei.tsarau@ntnu.no*

Abstract

This newly developed unique numerical model enables physically based high-fidelity simulations of ice management with the propeller flow of a ship. This model predicts the propeller-flow velocities, calculates the hydrodynamic forces on the ice and integrates the equations of motion of the ice cover, which is represented by an ensemble of rigid bodies that may interact with each other. Data from full-scale tests were used to calibrate the model to simulate the propeller-wash effect on ice floes and ice rubble. Another set of experimental data was utilised to validate the model against the measurements from full-scale trials in which an escort ship equipped with azimuth thrusters was employed to widen an old channel filled with ice rubble. The comparison showed good agreement between the measurements and the numerical results.

1 Introduction

Azimuth thrusters allow the application of full thrust in any horizontal direction (from 0° to 360°), providing the vessel with a range of outstanding operational capabilities. For ice-going ships, the steerable thrusters make it possible to break ice with the propeller jet and to wash

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