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Key Characteristics: Discrete Element Method • Ship - Ice Load Simulation • Brash Ice Numerical Model •

Numerical Simulation of Ship-Brash Ice Interaction

With the decrease of multi-year ice thickness in the Arctic region over the past decade, ship operations have increased significantly.

For safe and efficient operations of these ships, advanced tools are required in the designing process. In particular, evaluating the ability of ships to navigate through a broken ice channel is very crucial in the design stage to choose the optimum hull shape and powering. Brash ice is a channel of broken ice rubble accumulated together and a ship has to push this ice rubble away when navigating through it.

Added resistance due to this brash ice is very crucial when selecting the main engine of a ship. A well-designed hull form will have less added resistance due to ice, saving fuel. In the present context, designers use class rules or model experiments to calculate added resistance. However, class rules based on empirical formulas tend to overestimate added resistance, while model experiments cost a lot.

Therefore, if it is possible to correctly estimate the added resistance due to brash ice in the early design stage, it will be very helpful to develop an optimum hull shape. Hence, this project carries out research to develop a numerical tool which can simulate ship-brash Ice interactions and calculate added resistance. Due to the nature of rubble, Discrete Element Method (DEM) is used to model brash ice •