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Numerical study of brash ice loads on ship hulls based on DEM-CFD

Tengchao Lu [1], Zaojian Zou [1,2]

[1]School of Naval Architecture, Ocean and Civil Engeering, Shanghai Jiao Tong University, Shanghai 200240, China, 403979181@qq.com
2. Collaborative Innovation Center for Advanced Ship and Deep-Sea Exploration, Shanghai 200240, China

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The brash ice loads on ship hulls are studied by coupling Discrete Element Method (DEM) and Computational Fluid Dynamics (CFD). The loads induced by brash ice on ship hulls and the interactions between ice floes are investigated by DEM. The hydrodynamics of ice floes, mainly including the drag force and the buoyance, is calculated by CFD. In the simulation, the ice floes are treated as discrete elements, and the ship hull is treated as rigid body with a certain speed. The contact forces between ice floes and ship hulls are determined by the Hertz-Mindlin (no-slip) contact model. The shape of ice floes is an approximate square composed of a number of spherical faces, which can reduce the computation cost. A validation of this method by comparison with the experiment data is presented. The numerical results show qualitative agreement with the experiment result. The reasons of deviations between numerical results and experiment data are discussed.