Simulation of Wave Induced Ice Brakeup Process Using Dilated Polyhedral Dem

Ji Li and Shunying Ji*

State Key Laboratory of Structural Analysis for Industrial Equipment, Dalian University of Technology, Dalian, China.

*Corresponding Author: Shunying Ji. Email: jisy@dlut.edu.cn.

Abstract: An important issue for MIZ (Marginal Ice Zone) simulation is the correct prediction of ice-wave interaction. The energy of wave will be eliminated and at the same time induces the breakage and fragment of level ice. To study ice failure and the floe-size distribution (FSD) after fracture will help to improve the accuracy of further numerical simulation. We present a three-dimensional DPDEM (Dilated Polyhedral Discrete Element Method) in which element is similar to the real shape of single block to simulate the ice fracture process under the wave load. A large number of polyhedral ice elements generated with Voronoi tessellation are bonded together to form integral level ice, and each bond pair can resist tensile compressive and moment due to interaction. The tensile strength of the sea ice is calibrated by a uniaxial tensile simulation, and each bonded pair is given a random fluctuation that follows normal distribution. The wave force is calculated by adding up buoyant and drag force of each polyhedron elements, which are functions of wave height and velocity. The broken ice generated by the fracture will continues to collide with each other in the wave field. The influence of wave period and amplitude, thickness and bond strength of level ice on sea ice fracture process was studied. In addition, we analyzed the size distribution of broken ice with those properties.

DOI:10.32604/icces.2019.05491