DEM analysis of sheltering effect of ice loads on multi-legs offshore structure

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Abstract

Discrete element method (DEM) is used to simulate the interaction between ice and multi-leg structures (MLS) in this paper. The DEM with bonding-breaking spherical particles is adopted to analyze the ice failure and the ice load. The bonding-breaking parameters in DEM including the inter particle strengths and the friction coefficient of bonded particles have been determined by the uniaxial compressive and three-point bending tests. During the interaction between the ice and the MLS, the sheltering, location of rear legs “in the shade” of the front ones, have obvious influence of ice failure process and ice loads. The presented in the paper main simulated results show effect of key parameters on the sheltering effect. The sheltering effect of MLS, with various ice conditions (e.g, ice drifting directions, ice speeds, ice thicknesses and ice concentrations), is analyzed by the sheltering coefficient of ice load and the ice failure process on each pile obtained by DEM. The mechanism of the sheltering effect of MLS is also discussed with considering the effect of free boundary. To validate the proposed model, the simulated sheltering coefficients of the ice load are compared with ISO19906 standard. The results show that the proposed DEM model can be benefit to analyze the ice failure and ice load on the MSL.

Keywords: **DEM, sheltering effect, bonding-breaking, ice failure**