Efficient Prediction on Hydrodynamic Characteristics of Net Cage in Waves Using Machine Learning

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ABSTRACT

As the net cage is deployed in open sea and exposed to extreme environmental loads such as typhoons and storm surges, the net cage becomes affected significantly by marine disasters and suffers heavily each year. An effective prediction of net cage structural failure before typhoons and storm surges is important for fish farmers implementing appropriate measures for hazard prevention. Generally, the hydrodynamic characteristics of a net cage are investigated using numerical simulation, physical model experiments, and field measurements. However, these traditional research methods are time consuming and low in efficiency. In this study, an artificial neural network (ANN) model is built such that the hydrodynamic characteristics of a net cage in waves can be predicted rapidly. The training data of the ANN model are generated by a well-developed numerical model from our previous studies. The parameters in the hidden layer of the ANN model are determined considering the prediction accuracy of the hydrodynamic results of the net cage. The ANN model is validated against a well-developed numerical model with satisfactory accuracy. Using the proposed ANN model, the hydrodynamic results of the net cage including the maximum tension in mooring lines, minimum effective-volume ratio, and maximum stress of the floating collar are predicted for various waves. Overall, the predicted results indicate a trend consistent with that of the previous studies. As the present model could predict the structural stress and deformation of the fish cage efficiently, it is highly advantageous for the safety assessment and risk analysis of a fish farm before the sudden attack of a typhoon. The rapid forecast of disaster is important for fish farmers to implement appropriate measures for hazard prevention.

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