Research on Prediction Method of Ship Impact Environment Based on Probabilistic Neural Network

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Abstract

The calculation and analysis of the impact environment under the underwater non-contact explosion load is the basis of the anti-explosion and anti-shock research of surface ships. Based on the probabilistic neural network, the prediction model of ship impact environment is established in this research, and the particle swarm algorithm and ant colony algorithm method are used for the optimization of network structure and the analysis of ship's spectral velocity, displacement and acceleration. More specifically, objectives of this research are as follows:

（1）According to the characteristics of the hull, the parametric design language APDL is utilized for the secondary development of ANSYS. The material and section properties are defined in detail, and the main structure of the hull is created, enabling rapid parametric modeling of ships.

（2）Using the user interface design language UIDL, customized visual parameter assignment menu system for ship parameterized rapid modeling, and the operation method of the parameterized rapid modeling interface is introduced in detail. The modal analysis of the rapid established ship model is given, and its natural frequency and mode shape are provided to verify the effectiveness of the parameteic rapid modeling method.

（3）Three-dimensional modeling of ships and numerical simulation of impact environment has been processed, and batch processing of data was collected through Python programming and extracted of feature parameters, and then established the database of ship impact environment, which is used for intelligent computing.

（4）Training probabilistic neural network models for ship impact environment prediction, the key parameters of probabilistic neural network are optimized by particle swarm optimization and ant colony algorithm. Finally, the complete intelligent prediction model is used to forecast the impact environment of the ship, and a higher forecasting accuracy is obtained.

Keywords: Rapid modeling, APDL, UIDL, impact environment; probabilistic neural network