Tech Science Press

PROCEEDINGS

Simulation of Underwater Explosion Shock Wave Propagation in Heterogeneous Fluid Field

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ABSTRACT

The underwater explosion could cause the serious damage to the naval ships. Investigating the underwater explosion problem is crucial for the development of marine military power. During the recent years, the underwater explosion dynamics in the homogeneous fluid field has been investigated by lots of researchers. However, there often exist sound speed thermoclines in the real ocean environment, which leads to a more complex fluid environment than the homogeneous fluid. The corresponding numerical calculations become more complicated. In order to fully understand the underwater explosion dynamics in the real ocean environment, we perform the numerical investigations on the underwater explosion dynamics in the heterogeneous fluid in this paper. The computational fluid domain is assumed as the acoustic medium and the whole fluid domain is divided into two parts with different sound velocities. By setting a source point located outside the fluid domain as the explosive, the shock wave loading acts on the bottom boundary of the fluid domain and then enters the interior fluid domain. The acoustic finite element method is adopted to simulate the propagation of underwater explosion shock wave in the heterogeneous fluid. The effects of sound velocity differences between two fluid parts on the shock loading are investigated.

KEYWORDS

Underwater explosion; shock wave propagation; heterogeneous fluid field; acoustic finite element method

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.