機械工学セミナー
Mechanical Engineering Seminar

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主催: 慶應義塾大学理工学部機械工学科
Department of Mechanical Engineering, Keio University

日 時(Date):
2017年2月16日(木)(Feb. 16, 2017 (Thu.)) 14:30～16:00

場 所(Venue):
セミナールーム 1(Seminar Room 1) (14-201))

講演題目(Title):

Compressible Multiphase Flow Analysis for Supercavitating Underwater Vehicle : drag reduction, water impact and 6DOF behavior

講演者(Speaker)

Prof. Park Warn Gyu
Dean, School of Mechanical Engineering,
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Abstract:

Ventilated supercavitation is known as one of the ways of reducing viscous drag on projectiles moving in the water. In this work, the numerical simulation of ventilated supercavitating flows is presented. The three-dimensional compressible multiphase homogeneous governing equations are based on the compressible Navier-Stokes equations.

For supervaitating underwater vehicle, both the natural cavity and the ventilation cavity were performed together. Verification was carried out by comparing with other experimental conditions. Computational analysis was also performed on the experimentally impossible region, and the results of the analysis were obtained.

A numerical analysis was performed on the water entry using the in-house code. Prediction of free surface change by an object has been performed. Impact force analysis was performed according to the shape of various water bodies and conditions of entry.

Analysis of underwater behavior in consideration of 6 DOF was also performed. A variety of underwater behavior patterns could be identified depending on the various sources of the object.

In addition, a seven-equation model has been devised for full fluid analysis, i.e., three mass conservations, three momentum conservations, and an energy conservation. The mass conservation equation is written for each fluid while the momentum and energy balance equations are written for the mixture. The solutions are validated for water flows over the cylinders with hemispherical and blunt noses. Results show good agreement with the published data.

In this study, we introduced supercavity, water impact, underwater behavior and complete fluid analysis. These results can be applied in various areas related to underwater. It can also be said that the results and in-house code have high reliability through various verification processes.

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