

**NUMERICAL ANALYSES OF FREE SURFACE FLOW
WITH THE ADVANCED VOF METHOD
USING STABILIZED BUBBLE FUNCTION ELEMENT**

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An advanced VOF (volume of fluid [1]) method is proposed for free surface problem on the incompressible viscous flow in this paper. The interface tracking method of the advanced VOF method employs digitizer method [2] of CIP (Cubic-Interpolated Propagation) to cope with the interface of the gas-liquid. The finite element method of improved bubble function element [3] is used to solve the incompressible Navier-Stokes equations. As for the numerical example of the presented method, the analyses of a single bubble were examined to investigate the feasibility of direct simulation of bubbly flows with surface tension. CSF model [4] was employed to consider the effect of surface tension. The bubble shapes and terminal velocities under wide range of Eotvos number and Morton number were calculated and compared with the experimental data summarized by D. Bhaga et al [5]. These results are good agreement with existing experimental data. Namely, the presented method could predict them well by assigning some cells to the bubble diameter. Therefore, it was confirmed that the advanced VOF method would enable us to simulate bubbly flows directly under a wide-range of flow conditions. As a result of these simulations, the relation between a bubble shape and velocity distribution was validated within the ranges.

References

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