A COUPLING METHOD OF FREE SURFACE FLOW USING FEM FOR BOUSSINESQ EQUATIONS AND NAVIER-STOKES EQUATIONS

J. Matsumoto¹* and K. Kashiyama²

¹ National Institute of Advanced Industrial Science and Technology (AIST), Namiki 1-2-1, Tsukuba, Ibaraki 305-8564, Japan, matsumoto-junichi@aist.go.jp, http://www.aist.go.jp/
² Chuo University, Kasuga 1-13-27, Bunkyo, Tokyo 112-8521, Japan, kaz@civil.chuo-u.ac.jp, http://www.civil.chuo-u.ac.jp/lab/keisan/index.html

Key Words: Coupling Method, 2D Shallow Water Flow, 3D Gas-Liquid Two-Phase Flow, Finite Element Method, MINI Element.

A coupling method based on an implicit mixed finite element method of two-dimensional Boussinesq equations and three-dimensional Navier-Stokes equations is proposed in this paper. A stabilized MINI element [1], bubble function element/linear element, with an implicit scheme in time is used to solve the Boussinesq equations [2] and the Navier-Stokes equations [3]. The stabilized MINI element means bubble function element stabilization method for triangular element and tetrahedral element. The estimation of gas-liquid interface for three-dimensional Navier-Stokes equations is employed an interface-capturing method based on a phase-field model (PFM) [3]. Cahn-Hilliard equation in PFM is applied to estimate the interface of gas and liquid. The stabilized MINI element is used to solve Cahn-Hilliard equation. Continuity condition satisfies for connecting the two-dimensional Boussinesq equations and three-dimensional Navier-Stokes equations [4]. A dam break problem is analyzed to verify presented coupling method as a computational example.

REFERENCES