

A Geometric Interpolation Scheme in Overset Meshes for the Piecewise Linear Interface Calculation Volume of Fluid Method in Multiphase Flows

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Abstract : Piecewise linear interface calculation (PLIC) schemes are widely used in the volume-of-fluid (VOF) method to capture interfaces in numerical simulations of multiphase flows. Dynamic overset meshes can be especially useful in applications involving component motions and complex geometric shapes. In the present study, the VOF value of an acceptor cell is evaluated in a geometric way that transfers the fraction field between the meshes precisely with reconstructed interfaces from the corresponding donor elements. The acceptor cell value is evaluated by using a weighted average of its donors for most of the overset interpolation schemes for continuous flow variables. The weighting factors are obtained by different algebraic methods. Unlike the continuous flow variables, the VOF equation is a step function near the interfaces, which ranges from zero to unity rapidly. A geometric interpolation scheme of the VOF field in overset meshes for the PLIC-VOF method has been proposed in the paper. It has been tested successfully in quadrilateral/hexahedral overset meshes by employing several VOF advection tests with imposed solenoidal velocity fields. The proposed algorithm has been shown to yield higher accuracy in mass conservation and interface reconstruction compared with three other algebraic ones.

Keywords : interpolation scheme, multiphase flows, overset meshes, PLIC-VOF method

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