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A New High-Order Immersed Interface Method for Numerical Simulation of Two-Phase Flow XIAOLIN ZHONG, UCLA — In recent years, there has been a strong interest in developing robust and accurate numerical methods for simulating complex flow with imbedded interface of discontinuity. Numerical simulations for these flows are challenging in many aspects. First, the interface geometry can be complex and can undergo change, merge and breakup during the course of the simulation. The most popular methods in modeling flow with interface surfaces are, among others, the volume of fluid method, front tracking method, and level-set methods. Second, the flow variables and their derivatives are usually not continuous across the interface. This discontinuity poses severe limitation in the accuracy of common CFD methods. The current available methods in treating the interface jump conditions, such as the Immerse Boundary Method, are mostly first order accurate at the interface. The Immersed Interface Method of Laveque and Li (1994) can reach a second order accuracy. But this method is very difficult to apply to complex 3-D flow problems. We present a new general high-order immersed interface method (2nd and 4th order in particular) for two-phase flow simulation. The method can be of arbitrarily high-order accuracy by using additional grid points on both sides of the interface, instead of jump conditions of higher order derivatives. The finite difference formulas for irregular grid points near the interface are derived either by a one-sided Taylor expansion or by a matched polynomial interpolation.

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