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A finite-volume/level-set method for simulating two-phase flows on unstructured grids

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Abstract

The conservative level-set method for capturing the interface between two fluids is combined with a variable density projection scheme to simulate incompressible two-phase flows on unstructured meshes. All equations are discretized by using a conservative finite-volume approximation on a collocated grid arrangement. A high order scheme based on a flux limiter formulation, is adopted for approximating the convective terms, while the diffusive fluxes are centrally differenced. Gradients are computed by the least-squares approach. Physical properties are assumed to vary smoothly in a narrow band around the interface to avoid numerical instabilities. The numerical method is validated against classical advection test and two-phase flow examples including topology changes.

Keywords: conservative level set method; finite volume method; flux limiter; incompressible two-phase flow; unstructured grid

1. Introduction

The numerical simulation of two-phase flows is a vast topic, with applications in a wide variety of environmental, geophysical and engineering situations (Scardiovelli and Zaleski, 1999). Due to inherent complexity

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