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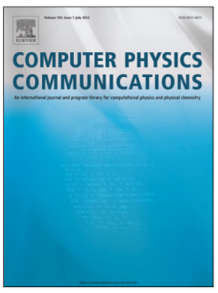

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Curvature computation in volume-of-fluid method based on point-cloud sampling

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Abstract

This work proposes a novel approach to compute interface curvature in multiphase flow simulation based on Volume of Fluid (VOF) method. It is well documented in the literature that curvature and normal vector computation in VOF may lack accuracy mainly due to abrupt changes in the volume fraction field across the interfaces. This may cause deterioration on the interface tension forces estimates, often resulting in inaccurate results for interface tension dominated flows. Many techniques have been presented over the last years in order to enhance accuracy in normal vectors and curvature estimates including height functions, parabolic fitting of the volume fraction, reconstructing distance functions, coupling Level Set method with VOF, convolving the volume fraction field with smoothing kernels among others. We propose a novel technique based on a representation of the interface by a cloud of points. The curvatures and the interface normal vectors are computed geometrically at each point of the cloud and projected onto the Eulerian grid in a Front-Tracking manner. Results are compared to benchmark data and significant reduction on spurious currents as well as improvement in the pressure jump are observed. The method was developed in the open source suite OpenFOAM® extending its standard VOF implementation, the `interFoam` solver.

Keywords: Volume of Fluid, curvature, OpenFOAM®, point-cloud.

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