

Moment-of-Fluid Interface Reconstruction Method for Multi-Material Fluid Flows

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We present a new volume-conservative interface reconstruction method, offering several major advantages over the traditional Volume-of-Fluid (VoF) methods.

The key feature of the new Moment-of-Fluid (MoF) method is utilization of the cell-wise material centroids for the interface reconstruction.

The location of the linear interface in each mixed cell is chosen to preserve the volumes and provide the best possible approximation to the material centroids.

The MoF construction of the linear interface in a mixed cell depends only on the moment data from within the cell and not on the data from its neighbors.

Therefore, the MoF method is able to resolve interface details as small as the cell itself, which are 2-3 times smaller than conventional VoF methods can resolve.

Also, the MoF interface reconstruction can be implemented as a cell-by-cell black-box routine, which is a great technological advantage over the VoF, especially in 3D.

The technique proposed is 2nd-order accurate and is shown to be more accurate than similar VoF methods.

Since the centroid of any Lagrangian parcel of incompressible fluid moves very much like a Lagrangian particle, the cell-wise material centroids can be updated in hydro simulations with sufficient accuracy.