*Proceedings of the 10th World Congress on Mechanical, Chemical, and Material Engineering (MCM'24)*
*Barcelona, Spain –August 22-24, 2024*
*Paper No. HTFF 216*
*DOI: 10.11159/htff24.216*

# A Conservative One-Cell Thick Vof Method on Adaptive Octree Grids

**Wasy Akhtar**
Element Digital Engineering
14805 Yorktown Plaza Drive, Houston, TX, 77040, USA
wasy.akhtar@element.com

## Extended Abstract

Computation of multiphase flows including boiling flows is one of the most challenging problems in CFD. Discontinuities in fluid properties, in addition to flow variables at the interface, lead to challenges in getting an accurate estimate of the gradients at the fluid-fluid interface with reasonable accuracy. Further, with a diffuse approach like VoF (Volume-of-Fluid) or Level-Set, solution accuracy requires a careful choice of reconstruction scheme to limit interface diffusion. "Diffuse" approach here refers to interface capturing schemes vs. Lagrangian type schemes like the marker-particle method. Several interface reconstruction schemes like PLIC (Piecewise Linear Interface Construction), HRIC (High-Resolution Interface Capturing Scheme), VoF with height functions exist within the VoF framework that offer different levels of interface capturing accuracy.

A one-cell thick moving interface is implemented to model the interface location and orientation using a VoF framework. Since the accuracy of the interface depends on grid resolution, a dynamic octree grid is employed to keep computational cost reasonable. After the interface is advected, volume fraction data is passed to a geo-reconstruct scheme on unity aspect ratio computational cells, which is consistent with the reconstruction algorithm. This approach is applied to several cases including Rayleigh Taylor instability, vortex in a box test and the Enright deformation test to demonstrate both the accuracy and the efficiency of the implementation. It is demonstrated that thin-filaments can be resolved as the Rayleigh Taylor instability grows with time leading to self-similarity. The accuracy of resolving thin filaments for the vortex in the box test case and Enright deformation test are similar to that of Particle-level set method of Fedkiw's group.

.