abstract
The goal of this paper was to do an analysis of two-dimensional unsplit mass and momentum conserving Finite Volume Methods for Advection for Volume of Fluid Methods with interfaces and validating their rates of convergence. Specifically three unsplit transport methods and one split transport method was amalgamated individually with four Piece-wise Linear Reconstruction Schemes(PLIC) i.e. Unsplit Eulerian Advection (UEA) by Owkes & Desjardins, 2014, Unsplit Lagrangian Advection (ULA) by Yang et. al., 2010, Split Lagrangian Advection (SLA) by Scardovelli & Zaleski, 2003 and Averaged Unsplit Eulerian Lagrangian Advection (AUELA) with 2 Finite Difference Methods by (Parker & Youngs, 1992) and 2 Error Minimization Methods by (Pilliod Jr & Puckett, 2004). The observed order of accuracy was first order in all cases except when Unsplit Methods and Error Minimization Methods were used consecutively each iteration, which resulted in second order accuracy on the shape error convergence. The Averaged Unsplit Eulerian Lagrangian Advection(AUELA) did produce first order accuracy but that was due to temporal error in the numerical setup. The main unsplit methods, Unsplit Eulerian Advection(UEA) and Unsplit Lagrangian Advection (ULA), preserve mass and momentum and require geometric clipping to solve two-phase fluid flows. The Unsplit Lagrangian Advection (ULA) can allow for small divergence in the velocity field perhaps saving time on the iterative solver of the variable coefficient Poisson System.