

Mechanical Engineering Master's Defense

A Comparison of Performance between Reconstruction and Advection algorithms for Volume-of-Fluid methods

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abstract

The Volume-of-Fluid algorithm is a popular interface-capturing method for the tracking of a free surface in numerical simulation of a fluid dynamics problem. When coupled with a numerical flow solver like the discrete Navier-Stokes equations, the interaction of two-phase flows can be predicted. For accurate prediction and understanding of interfacial flows, an accurate Volume-of-Fluid interface-capturing scheme is necessary.

Many different re-formulations of the Volume-of-Fluid method exist. A study of the influence that reconstruction and advection algorithms have on the performance of the Volume-of-Fluid method is presented. Three reconstruction algorithms are compared, the finite difference formulation, the Least-Squares Volume-of-Fluid Interface Reconstruction Algorithm, and the Efficient Least-Squares Volume-of-Fluid Interface Reconstruction Algorithm. Also, three separate formulations for the advection of the fluid are compared. The advection algorithms studied are an operator-split translation of an interface, an operator-split formulation that allows stretching and compressing on an interface, and finally a conservative unsplit geometrical advection method. A comparison is drawn by comparing transportation errors as well as the time spent during these calculations.



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