NEW METHODS FOR ORDER-INDEPENDENT MULTI-MATERIAL INTERFACE RECONSTRUCTION

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We present two new methods for volume-conservative order-independent interface reconstruction in multi-material (more than 3 materials) flow simulations. This is different from the commonly used methods which, at best, carve out material regions from a cell sequentially, making the reconstruction material-order dependent. All the methods we present recover the approximate location of the material centroids in cells from only volume fraction data. Then a weighted Voronoi diagram of these approximate centroids is constructed in each cell to partition the cell into material regions that match the input volume fractions exactly.

The first method we will present uses a particle attraction-repulsion model to compute approximate centroid locations in the cell. This method can recover some features, such as filaments inside a cell, that traditional interface reconstruction methods cannot.

The second method we present computes the approximate centroid of materials in the cell by performing a monotonic linear reconstruction of the ``volume fraction function''. This is followed as before by a power diagram subdivision into pure-material subcells. The method gives very good results for regular grids and has been successfully extended to general unstructured meshes.

In addition, we will present the results of our investigation into smoothing techhniques for making these reconstructions second-order accurate. Finally, we will present our studies on the effects of this reconstruction on advection procedures in multi-material flows.