Volume Preserving Level Set Methods

Ian Mitchell

`mitchell@sccm.stanford.edu`

Stanford, US

Because they are solved on discrete grids, level set methods frequently suffer from errors induced by incorrect gain or loss of volume in regions where the evolving surface has high curvature. We describe a scheme which combines level sets and particles to overcome this deficiency. The particles are used to detect where the level set has failed to preserve volume and to correct it, while the level set is used to provide geometric information about the surface and to minimize particle computation overhead—particles are needed only in grid cells close to the surface. We compare the accuracy and speed of this mixed scheme with competing techniques on two and three dimensional problems from computational fluid dynamics and optimal control. This work is a collaboration between Doug Enright, Ron Fedkiw, Joel Ferziger and Ian Mitchell.