

A conservative maximum principle preserving one-stage artificially compressed level set method for two-phase incompressible flow under ALE formulations

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Collaborators

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Objectives

Transport a level set function reducing numerical oscillations and dissipation. For sake of simplicity we are interested on a one-stage reinitialization process that works for unstructured meshes and that is high-order in space and time.

Results

We present a conservative level set method discretized in space using continuous Galerkin finite elements and stabilized via balanced artificial diffusion and artificial compression based on the entropy production. The method is second order, preserves the maximum principle locally via the Flux Correction Transport methodology, is suitable for unstructured meshes and doesn't require a post-processing re-initialization of the level set function. We present results implemented in Proteus in two dimensions considering first an Eulerian framework and, afterwards, an Arbitrary Lagrangian Eulerian framework. Finally, we present results where this methodology is linked with a Navier-Stokes solver to simulate two phase flow in two and three dimensions.

Conclusions and remarks

We assume the velocity is divergence free which allows us to consider the transport equation as a linear conservation law. We then apply a conservative discretization. This guarantees the transported quantity (the level set function) is conservative. This, however, doesn't imply that the volume of any of the fluids (during a two-phase flow interaction) is conserved. Nevertheless, numerical experiments suggests the loss in volume of the fluids converges to zero. We are working with existing methods to combine this methodology with a volume of fluid method to guarantee the volume of both fluids is conserved without the need of interface reconstruction.