Advances in the Fixed-Mesh ALE method for embedded meshes

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ABSTRACT

In this work we present some recent advances in the Fixed-Mesh ALE method for flow problems using embedded methods. In particular we focus in three main topics: the computation of time derivatives in a domain which evolves in time using a fixed framework, the imposition of essential boundary conditions and the use of an adaptive mesh refinement framework framework capable of concentrating computational power in the regions where it is required.

Some of other ingredients of the formulation are the use of an Arbitrary-Lagrangian-Eulerian formulation for computing temporal derivatives, the use of stabilization terms for stabilizing convection, stabilizing the lack of compatibility between velocity and pressure interpolation spaces, and stabilizing the ill-conditioning introduced by the cuts on the background finite element mesh, and the coupling of the algorithm with an adaptive mesh refinement procedure suitable for running on distributed memory environments. Algorithmic steps for the projection between meshes are presented together with the algebraic fractional step approach used for improving the condition number of the linear systems to be solved.

Numerical examples are presented showing the behavior of the proposed methodology.

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