

On Explicit/Implicit and Incompressible/Compressible Issues of Immersed Boundary/Continuum Methods

by

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Abstract

In addition to an overview of the immersed boundary/continuum methods and their finite element formulations, explicit *vs.* implicit and incompressible *vs.* compressible issues are discussed. The recent finite element formulations retain the same strategies employed in the original immersed boundary method, namely, the independent Lagrangian solid mesh moves on top of a fixed or prescribed background Eulerian fluid mesh. The added features in recent finite element formulations are the generality of the immersed solid which can occupy a finite volume in the fluid and be impermeable, compressible, and highly deformable. Furthermore, a matrix-free Newton-Krylov iterative solution technique also resolves the time step limitation issues related to stiff spring supports from the boundary and the high elasticity moduli of the immersed solid. This implicit iterative approach enables the application of immersed methods to many engineering problems some of which are documented here for illustrative purposes.

Keywords: Immersed Boundary Method, Kernel, Meshless, Fluid-Structure Interaction, Compressible, Explicit, Implicit, and Mixed Finite Element Formulation.

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