Immerse Boundary Cell-based Smoothed Finite Element Method for Incompressible Laminar Flow

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Abstract

In this paper, an immersed boundary smoothed finite element method (IBS-FEM) is proposed to solve incompressible fluid flow problems. In previous immersed S-FEM, the coupling algorithm between fluid and solid is immersed domain method which adopted the fictitious fluid idea. Present method apply the coupling conditions based on the boundaries of immersed bodies. Therefore, the coupling calculation is more efficiency and more proper for extremely thin immersed structures. In proposed method, the incompressible flow is solved by Cell-based S-FEM using Characteristic-Based Split (CBS) scheme. To verify proposed method and check its stability, the several fluid-structure benchmarks are calculated. As a comparison, the solutions immersed S-FEM are also calculated. Results demonstrate that IBS-FEM is able to solve the incompressible flows using non-body-fitted structured mesh.

Keywords: Cell-based S-FEM, Immerse Boundary, Quadrilateral element, Incompressible laminar flow