Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Advanced immersed boundary method for complex moving/morphing boundaries based on hybrid ghost-cell and virtual cut-cell KAMAU KINGORA, HAMID SADAT, University of North Texas — The state of art of sharp interface immersed boundary (IB) methods (cut-cell and ghost-cell (GC) methods) today is that they lack generality and are specialized in nature. Consequently, their extension to problems with multiple potentials is not straightforward. We propose an accurate and robust advanced immersed boundary method (AIBM) for simulation of fluid structure interaction (FSI) in complex flow. This novel sharp interface IB method entails addition of a generic virtual force to the underlying governing equation for the purpose of enforcing desired boundary conditions on different field variables like velocity, temperature, chemical species etc. AIBM employs virtual cut-cell techniques which makes AIBM easy to implement and parallelize, and also applicable to multiphase flow on grid with high aspect ratio, unlike GC method which rely on interpolation. Solid part of simulation domain is logically eliminated from computation matrix hence AIBM is capable of simulating internal and/or external flow with large number of cells in the solid region. Fresh-cell problem is tackled by a field extension technique, enabling AIBM to simulate FSI with moving and/or deforming boundary without pressure oscillations and spurious forces. We validated the proposed method by running benchmark cases using our in-house solver, CFDFoam. The results predicted by AIBM are in good agreement with experimental studies.

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Date submitted: 01 Aug 2019 Electronic form version 1.4