A LES-DEM-VOF METHOD FOR TURBULENT THREE PHASE FLOWS

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In this work a robust Computational Fluid Dynamic (CFD) - Discrete Element Method(DEM) coupling that can predict free-surface, turbulent flows is presented. A correct prediction of multiphase turbulent flows should ideally be able to capture the discrete dynamics of a dispersed phase (solid particles), and at the same time to take into account the evolution of possible fluid-dynamic instabilities. In this optic a CFD-DEM approach seems promising as it is able to combine the well developed CFD techniques for the study of free-surface flows with the accuracy of the Discrete Particle Method(DPM). A key point of the CFD-DEM method is the coupling between the discrete and the continuous phases. In particular the volume replacement between phases, and the interaction between the discrete phase and the continuous interface must be taken into account in order to perform accurate three phase simulations.

In this work two different approaches to simulate the volume replacement between phases are presented and compared within a four way coupling with a Large Eddy Simulation(LES)-Volume Of Fluid(VOF) solver. The four-way coupled equations for the solid and the fluids are then presented, and some test cases provided in order to evaluate the accuracy of the new solver.

Particular emphasis is posed to study the effects of the coupling on the interface dynamics and stability. The continuous two-phase solver used for the simulations is based on the OpenFoam® architecture, while the discrete phase solver is built on the XDEM code.