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A hybrid PIC-DEM approach for multi-phase computational fluid dynamics¹ ROBERTO PORCU, ANN ALMGREN, MICHELE ROSSO, Lawrence Berkeley National Laboratory, JORDAN MUSSER, National Energy Technology Laboratory, WILLIAM FULLMER, National Energy Technology Laboratory; Leidos Research Support Team, ANDREW MYERS, OSCAR ANTEPARA, Lawrence Berkeley National Laboratory — MFiX-Exa is a new code being developed by the National Energy Technology Laboratory and Lawrence Berkeley National Laboratory as part of the U.S. Department of Energy's Exascale Computing Project. MFiX-Exa originated by combining the discrete element method (DEM) modules of the classic MFiX code (mfix.netl.doe.gov) with a modern low Mach number projection method for the continuous fluid phase. The new algorithm is implemented using the AMReX software framework for massively parallel block-structured applications (amrex-codes.github.io). Despite the ever-increasing computational power offered by world-leading supercomputers, DEM is still prohibitively expensive for the modeling of large industrial-scale problems. Other methods, as particle-in-cell (PIC), are less computationally intensive, but they tend to be less accurate than DEM. In this work, we exploit the efficiency of PIC and accuracy of DEM to introduce a hybrid multi-phase PIC-DEM approach. Overall, the strategy relies on applying the PIC model to particle-dense regions while keeping the DEM model for the dilute parts of the domain. Within this setup, the modeling of the PIC/DEM transitions is proposed. The method and results are to be presented in the context of chemical loop reactors simulations.

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