

Overview of Computational Modeling of Multiphase Turbulent Flows

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Lagrangian and Eulerian computational approaches for analyzing multiphase flows are described. Fundamentals of Eulerian modeling approach are outlined and attention is given to modeling in turbulent multiphase flows. The numerical simulations procedure with use of Reynolds averaged Navier-Stokes (RANS) equation, as well as DNS and LES are described. Recent advances in Lagrangian particle tracking are discussed. Transport and dispersion of nano- and micro-particles in flow stream are discussed. The effects of hydrodynamic forces including drag and lift acting on small particles suspended in fluid are described. The importance of Cunningham slip correction as well as the Brownian motion for nano-size particles is pointed out. The stochastic models for simulation of instantaneous turbulent flow are also discussed. Sample applications of computational modeling of particle transport and deposition from erosion in pipe lines, three-phase slurry reactor, to human airway passages are presented. The application of multiphase flows to carbon sequestration, natural gas production from hydrate, and enhanced oil and gas recovery are also discussed. It is shown that computational modeling provided an efficient tool for studying multiphase flows in complex passages.