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Modeling and Prediction of the Effects of Collisions in a Gas-Solid Turbulent Channel Flow Using Moment Methods DENNIS DUNN, KYLE SQUIRES, Arizona State University — Modeling dispersions of particles in multiphase flows is especially challenging in gas-solid suspensions. Lagrangian methods are suitable for dilute particle mediums, but are not cost effective at denser concentrations and impose additional modeling challenges. A moderately dense particle phase is neither sufficiently dense for a continuum limit assumption (collisional equilibrium) nor sufficiently dilute for a Lagrangian method, and resides in the intermediate regime under consideration in the current work. A quadrature-based moment method (QBMM) is chosen to simulate a particle-laden turbulent channel flow considering inter-particle collision effects. In quadrature-based approaches similarly behaving particles may be grouped together and treated in a stochastic manner within an Eulerian framework. Specifically, the Conditional Quadrature Method of Moments (CQMOM) is implemented to discretize a fully 3-D velocity space and capture particle trajectory crossing (PTC). This has the potential for large computational savings as compared to Lagrangian methods, especially when dense collisions are prominent. The probability density function is discretized with a two-point-quadrature in each dimension – the minimum requirement to capture PTC and enforce collisions. Predictions of the channel flow demonstrate that the collision treatment leads to the expected effects (e.g., redistribution of kinetic energy) and also offer improved accuracy relative to simpler approaches.

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