Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Anisotropic Stochastic Vortex Structure Method for Simulating Particle Collision in Turbulent Shear Flows[1] FARZAD DIZAJI, JEFFREY MARSHALL, JOHN GRANT, XING JIN, University of Vermont — Accounting for the effect of subgrid-scale turbulence on interacting particles remains a challenge when using Reynolds-Averaged Navier Stokes (RANS) or Large Eddy Simulation (LES) approaches for simulation of turbulent particulate flows. The standard stochastic Lagrangian method for introducing turbulence into particulate flow computations is not effective when the particles interact via collisions, contact electrification, etc., since this method is not intended to accurately model relative motion between particles. We have recently developed the stochastic vortex structure (SVS) method and demonstrated its use for accurate simulation of particle collision in homogeneous turbulence; the current work presents an extension of the SVS method to turbulent shear flows. The SVS method simulates subgrid-scale turbulence using a set of randomly-positioned, finite-length vortices to generate a synthetic fluctuating velocity field. It has been shown to accurately reproduce the turbulence inertial-range spectrum and the probability density functions for the velocity and acceleration fields. In order to extend SVS to turbulent shear flows, a new inversion method has been developed to orient the vortices in order to generate a specified Reynolds stress field. The extended SVS method is validated in the present study with comparison to direct numerical simulations for a planar turbulent jet flow.

[1]This research was supported by the U.S. National Science Foundation under grant CBET-1332472.

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Date submitted: 21 Jul 2017 Electronic form version 1.4