Abstract Submitted
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3-D conditional hyperbolic method of moments for high-fidelity Euler–Euler simulations of particle-laden flows[1] RAVI PATEL, Cornell University, BO KONG, Ames Laboratory, JESSE CAPECELATRO, University of Michigan, RODNEY FOX, Iowa State University, OLIVIER DESJARDINS, Cornell University — Particle-laden turbulent flows are important features of many environmental and industrial processes. Euler–Euler (EE) simulations of these flows are more computationally efficient than Euler–Lagrange (EL) simulations. However, traditional EE methods, such as the two-fluid model, cannot faithfully capture dilute regions of flow with finite Stokes number particles. For this purpose, the multi-valued nature of the particle velocity field must be treated with a polykinetic description. Various quadrature-based moment methods (QBMM) can be used to approximate the full kinetic description by solving for a set of moments of the particle velocity distribution function (VDF) and providing closures for the higher-order moments. Early QBMM fail to maintain the strict hyperbolicity of the kinetic equations, producing unphysical delta shocks (i.e., mass accumulation at a point). In previous work, a 2-D conditional hyperbolic quadrature method of moments (CHyQMOM) was proposed as a fourth-order QBMM closure that maintains strict hyperbolicity. Here, we present the 3-D extension of CHyQMOM. We compare results from CHyQMOM to other QBMM and EL in the context of particle trajectory crossing, cluster-induced turbulence, and particle-laden channel flow.

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