Abstract Submitted
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An improved numerical method for the kernel density functional estimation of disperse flow[1] TIMOTHY SMITH, University of Illinois at Urbana-Champaign, REETESH RANJAN, Georgia Institute of Technology, CARLOS PANTANO, University of Illinois at Urbana-Champaign — We present an improved numerical method to solve the transport equation for the one-point particle density function (pdf), which can be used to model disperse flows. The transport equation, a hyperbolic partial differential equation (PDE) with a source term, is derived from the Lagrangian equations for a dilute particle system by treating position and velocity as state-space variables. The method approximates the pdf by a discrete mixture of kernel density functions (KDFs) with space and time varying parameters and performs a global Rayleigh-Ritz like least-square minimization on the state-space of velocity. Such an approximation leads to a hyperbolic system of PDEs for the KDF parameters that cannot be written completely in conservation form. This system is solved using a numerical method that is path-consistent, according to the theory of non-conservative hyperbolic equations. The resulting formulation is a Roe-like update that utilizes the local eigensystem information of the linearized system of PDEs. We will present the formulation of the base method, its higher-order extension and further regularization to demonstrate that the method can predict statistics of disperse flows in an accurate, consistent and efficient manner.

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