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Representing Number Fluctuations in Disperse Multiphase Flow using the Filtered Klimontovich Density[1] SHANKAR SUBRAMANIAM, Department of Mechanical Engineering, Center for Multiphase Flow Research and Education (CoMFRE), Iowa State University — Fluctuations in number of particles, droplets or bubbles are closely related to clustering phenomena and instabilities in disperse multiphase flow that can span a wide range of time and length scales. The number density function (NDF) in gas-solid flow, and its equivalent the droplet distribution function (DDF) in sprays, forms the basis of kinetic theory descriptions of disperse multiphase flow. The NDF (DDF) is the ensemble average of the Klimontovich density (KD) and represents first-order ensemble-averaged quantities such as the ensemble-averaged particle number density and volume fraction. The NDF does not contain information concerning fluctuations in particle number (or volume). Spatial filtering of the KD has the advantage of capturing scale–dependent fluctuations and is a path to rigorously incorporate second–order statistical information characterizing number fluctuations by explicitly modeling it in a one–particle theory. I propose a new Euler-Lagrange formulation involving spatial filtering of the KD, but its promise can be realized only insofar as the accuracy of models for the unclosed terms in its transport equation. PR–DNS can be used to quantify these unclosed terms at the microscale because the formulation is reconcilable across micro, meso and macroscales.

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