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Momentum exchange in multiphase dispersed flow: a statistical estimator based on multilevel Monte Carlo MATTEO ICARDI, King Abdullah University of Science and Technology — Eulerian-Eulerian models for multiphase dispersed flow are commonly derived by means of ensemble (or spatial) averaging. They are therefore based on quantities defined over statistical (or spatial) ensemble of particle configurations. However momentum exchange correlations (e.g., drag, lift) are known (and can be defined deterministically) only for the dilute (isolated spheres) and dense (Ergun) limits. Furthermore it is well known that the overall results are often very sensitive to the correlation chosen and to the closure approximations for fluctuations, strongly limiting the predictive capability of the models. In this work the forces acting on random array of spheres and other granular objects have been studied with a novel statistical approach based on multilevel Monte Carlo. Direct Numerical Simulations are used to resolve the flow around the spheres and both the numerical and statistical error are controlled accurately. Mean and fluctuations of the momentum exchange terms can be characterized to derive new correlations for drag and lift in dense poly-dispersed flows that are statistically robust.

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