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Pairwise Interaction Extended Point Particle (PIEP) Model for a Random Array of Spheres. GEORGES AKIKI, Univ of Florida - Gainesville, THOMAS JACKSON, SIVARAMAKRISHNAN BALACHANDAR, University of Florida, CENTER FOR COMPRESSIBLE MULTIPHASE TURBULENCE TEAM — This study investigates a flow past random array of spherical particles. The understanding of the governing forces within these arrays is crucial for obtaining accurate models used in particle-laden simulations. These models have to faithfully reflect the sub-grid interactions between the particles and the continuous phase. The models being used today assumes an average force on all particles within the array based on the mean volume fraction and Reynolds number. Here, we develop a model which can compute the drag and lateral forces on each particle by accounting for the precise location of few surrounding neighbors. A pairwise interaction is assumed where the perturbation flow induced by each neighbor is considered separately, then the effect of all neighbors are linearly superposed to obtain the total perturbation. Faxén correction is used to quantify the force perturbation due to the presence of the neighbors. The single neighbor perturbations are mapped in the vicinity of a reference sphere and stored as libraries. We test the Pairwise Interaction Extended Point-Particle (PIEP) model for random arrays at two different volume fractions of $\phi = 0.1$ and 0.21 and Reynolds number in the range $16 \leq Re \leq 170$. The PIEP model predictions are compared against drag and lift forces obtained from fully-resolved DNS performed using immersed boundary method. We observe the PIEP model prediction to correlate much better with the DNS results than the classical mean drag model prediction.

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