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Highly-scalable simulation of turbulent and particle-laden flows using the lattice Boltzmann approach CHARLES ANDERSEN, ORLANDO AYALA, HUI GAO, LIAN-PING WANG, University of Delaware — Particle-laden turbulent flows are found in many applications such as sediment transport, pollutant dispersion, interaction of cloud droplets, and chemical processing. Recently, we have developed a particle-resolved direct simulation of particle-laden turbulent flow using the mesoscopic lattice Boltzmann approach. Here we explore the parallel scalability of this approach by comparing the parallel efficiencies of the code using one, two, and three dimensional domain decompositions. First, we compare the scalability data of the turbulent flow simulation without particles and show that the communication overhead in the approach is negligible due to the local nature of data communication. Then, we discuss parallel implementation issues related to the interaction of solid particles with the carrier turbulent flow. The new results based on multiple dimensional decompositions will be compared to the previous results using one dimensional domain decomposition. Results from high-resolution particle-resolved multiphase flow simulations will be used to address flow modulation by finite-size solid particles when the size of the particles is comparable to or larger than the flow Kolmogorov scale.

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