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A hierarchical Cartesian method for particle-laden flows with conjugate heat transfer[1] GONZALO BRITO GADESCHI, MATTHIAS MEINKE, WOLFGANG SCHROEDER, Institute of Aerodynamics, RWTH Aachen University — We present a numerical method for simulating particle-laden flows including conjugate heat transfer between the fluid and the particle phase, where the particles are fully-resolved. This is a challenging problem since the flow field around the moving particles as well as the heat exchange across the particles surface has to be resolved at any time instant. It is also computationally expensive when particles with a diameter on the order of, or smaller than, the Kolmogorov length require a local mesh resolution which exceeds that of a Direct Numerical Simulation of the turbulent fluid phase alone. The present approach uses an efficient adaptive algorithm to couple the two numerical methods for the fluid phase and the heat conduction in the particles. The algorithm is based on hierarchical Cartesian grids and is especially suited for moving boundary problems. The fluid phase is solved with a thermal Lattice-Boltzmann method while the heat equation in the particle phase is discretized based on a finite volume method. The moving surface of the particles is tracked using a level-set method. The approach is validated against results available from the literature and its applicability is demonstrated it by studying canonical problems of suspended rigid particles in channel-like flows.

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