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Effects of solid inertial particles on the velocity and temperature statistics of wall bounded turbulent flow BAMDAD LESSANI, South Dakota School of Mines and Technology, HADI NAKHAEI, Technical University of Denmark — The effect of solid inertial particles on the velocity and temperature statistics of a non-isothermal turbulent channel flow is studied using direct numerical simulation.A two-way coupled Eulerian-Lagrangian approach is adopted.Three different particle Stokes numbers of St= 25, 60, 200, at a constant particle mass loading of $\phi_m = 0.57$, are considered. The variations of different budget terms for the turbulent kinetic energy equation and fluctuating temperature variance equation in the presence of particles are reported. It is shown that the near wall dissipation and viscous transport terms are larger for St = 25 particles compared to the ones of higher inertia particles (St = 60, 200). The same behavior is observed for the dissipation and viscous transport terms of the fluctuating temperature variance equation. The fluid turbulent heat flux is also reduced by the presence of particles, but as a result of fluid-particle heat exchange, the total heat transfer rate stays always higher for particle-laden flow even for the largest particles considered. The total Nusselt number is split into a turbulence contribution and a particle contribution, and the effects of particles inertia on fluid turbulent heat flux and fluid-particle heat transfer are examined.

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