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Heat transfer in ordered and random arrays of spheres at low Reynolds number RAHUL GARG, SUDHEER TENNETI, Iowa State University, MADHUSUDAN PAI, Center for Turbulence Research, Stanford University, SHANKAR SUBRAMANIAM, Iowa State University — Direct simulation of passive scalar transport in steady flow past arrays of spheres is performed using the immersed boundary method. We investigate the dependence of the Nusselt number on different sphere arrangements (simple cubic, face–centered cubic and random) as a function of solid volume fraction and Reynolds number ($0.01 < Re < 20$) for Prandtl number $\mathrm{Pr} = 0.7$. Our results compare well with the established correlations for low solid volume fractions (< 0.1). At higher solid volume fractions, existing correlations are found to underpredict the heat transfer with significant departures in the Nusselt number at the highest volume fraction of 0.4. The simulations motivate an improved heat transfer correlation for gas-solids flow at low Reynolds numbers.

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