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Direct numerical simulations of heat transfer in liquid-solid circulating fluidized beds LUCA BRANDT, Department of Mechanics - KTH Royal Institute of Technology , MEHDI NIAZI ARDEKANI, Department of Chemical Engineering - Stanford University, MOHAMMAD MAJLESARA, Department of Mechanics - Shiraz University , CHRISTOPHE DUWIG, Department of Mechanics - KTH Royal Institute of Technology, OMID ABOUALI, Department of Mechanics - Shiraz University — Controlling heat and mass transfer in particulate suspensions has many important applications such as packed and fluidized bed reactors and industrial dryers. In this work, we study the effect of particle volume fraction and Galileo number on the heat transfer within suspensions of rigid spherical particles in liquid-solid circulating fluidized beds (L-S CFBs). To this purpose, particle-resolved direct numerical simulations (PR-DNS) are performed, using the immersed boundary method (IBM) to account for the solid-fluid interactions and a volume of fluid (VoF) approach to resolve the temperature equation both inside and outside the particles. A vertical box is considered as numerical domain, where hot particles are introduced at the bottom of the box in the presence of a cold inflow, cooling down during their rise to the top of the box. Different Galileo numbers are simulated at various particle volume fractions up to 10%. The average particle velocity and temperature are monitored, aiming to maximize the heat transfer while also accelerating the process. Our results indicate an optimum Galileo number where the efficiency of the heat transfer process is maximum. Detailed statistics of the fluid and particle phase will be presented at the conference.

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