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Particle Scale Heat Transfer Calculations and Flow Characteristics in a Fluidized Bed with Immersed Tube by CFD-DEM Approach NAVEEN RAJ NANNAMKERIL[1], Indian Institute of Technology Madras, DANESH K TAFTI[2], Virginia Tech, Blacksburg, VA, S VENGADESAN[3], Indian Institute of Technology Madras — A combined approach of discrete element method and computational fluid dynamics is used to study the heat transfer behaviour in a fluidised bed with an immersed tube. A method to resolve particle-particle and particle-wall unsteady conduction heat transfer is developed within the framework of the soft sphere collision model. The unsteady heat transfer model is incorporated into an existing CFD-DEM framework. The model is derived from the analytical solution of one-dimensional unsteady heat conduction between two semi-infinite objects. The model considers the area and time of contact with appropriate scaling for compatibility with the soft sphere model. The model is validated against experimental data available from the literature. The model is applied to a fluidized bed with an immersed tube to characterize the heat transfer mechanisms and the effective heat transfer coefficient. The relative importance of various heat transfer mechanisms is analysed. The requirement of the coarse grid for coupled CFD-DEM near the boundaries are overcome with a particle grid formulation. Hence the dynamic large eddy simulation turbulence model resolved the boundary layer precisely around the tube surface. The continuity in void fraction near the wall is also retained.

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