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Gravitational Effects in Turbulent Two-Phase Heat Transfer in Horizontal Channels ILYAS YILGOR, PRAMOD BHUVANKAR, SADEGH DABIRI, Purdue University, DABIRI RESEARCH TEAM — Present work explores heat transfer in horizontal turbulent bubbly flows. High fidelity direct numerical simulations (DNS) are conducted using finite volume and front-tracking methods to analyze the turbulent two-phase heat transfer between two parallel walls with Dirichlet boundary conditions at different temperatures for Eötvös and Archimedes numbers ranging from 0.03-0.6 and 500-10000, respectively. Non-condensable bubbles are present in the flow with a void fraction of 3% and Reynolds numbers ranging from 3000 to 5000. Two-phase simulations are compared to the corresponding single phase simulations with the same flow rate. The improvement in Nusselt number relative to single phase flow is quantified. A critical region where the improvement in heat transfer due to the presence of bubbles equals the convection heat transfer loss due to a reduced flow rate for a constant pressure gradient is documented. Change of void fraction distributions with gravity, flow rates, average Nusselt numbers and shear stresses are also presented. A range of parameters yielding optimum heat transfer are given.

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