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Direct numerical simulation of heat transfer in turbulent bubbly pipe flow[1] IN-KOO LEE, JAEHEE CHANG, HAECHEON CHOI, Seoul National University — In pipe flows occurred in a reactor of a nuclear power plant and a radiator tube in a car, forced convection with bubbles occasionally occurs in an undesirable manner. These bubbles significantly change the flow structures and heat transfer in a pipe. We perform direct numerical simulation of fully developed turbulent bubbly flow with heat transfer in a vertical pipe to examine the variations of flow structure and heat transfer due to bubbles. The phase interface is tracked by level-set method in the Cartesian coordinates. The simulation results show that heat transfer is enhanced by the motion induced by counter-rotating vortices existing in the rear of the bubble. As the bubble volume fraction increases, the radial distribution of bubbles becomes flat due to the interaction among bubbles. This flat bubble distribution results in flattened temperature profile in the radial direction. Therefore, the rate of increase in the heat transfer coefficient decreases with increasing bubble volume fraction.

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