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The effect of flow pattern around a bubble rising near a vertical wall, on the wall to liquid heat transfer. PRAMOD BHUVANKAR, SADEGH DABIRI, Purdue Univ — Two-phase flow is an effective means for heat removal due to the enhanced convective effect caused by bubbly flow and the usually high latent heat of vaporization of the liquid phase. We present a numerical study of the effect of flow patterns around a single bubble rising in shear flow near a vertical wall, on the wall-to-liquid heat transfer. The Navier-Stokes equations are solved in a frame of reference moving with the bubble, by using the front tracking method for interface tracking. Our simulations reveal an enhancement of heat transfer downstream of the bubble, and a less pronounced diminishment of heat transfer upstream of the bubble. We observe that in the range of $5 \leq Re \leq 40$ for Reynolds number based on shear and bubble diameter, heat transfer first increases, attains a maximum and decreases as Re increases. The optimum Re depends on the Archimedes number. The heat transfer enhancement is attributed to flow reversal happening in a confined region of the shear flow, in the presence of a bubble. The analytical solution of $2-D$ inviscid shear flow over a cylinder near a wall is used to identify two parameters of flow reversal namely 'reversal height' and 'reversal width'.These parameters are then used to qualitatively explain what we observe in $3-D$ simulations.

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