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The measurement of local flow parameters for gas-liquid two-phase bubbly flows using a dual-sensor probe array

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Abstract: Conductivity methods are commonly used in two-phase flow measurement due to their high sensitivity to the conductivity contrast between the both phases. In this study, a dual-sensor probe array is newly designed to measure the local parameters of vertical upward gas-liquid two-phase flows in a small inner diameter pipe. Firstly, the measurements of gas volume fraction and gas velocity profiles are conducted using the dual-sensor probe array. Then series of bubble chord lengths at different locations are derived based on the rising velocities of the bubbles, and are compared with a model of maximum bubble diameter. Additionally, based on the simultaneously measured signals from the dual-sensor probe array, the structures of multiple bubble groups are visualized using a technology of phase density image. In view of the existence of the multiple bubble groups, the transformation from bubble chord length distribution to bubble size distribution is conducted based on the decomposition of the multiple bubble groups in the chord length distribution, and the evolution characteristics of the bubble size distributions at the pipe cross section are investigated as the flow condition changing.

Keywords: Gas-liquid two-phase flow; dual-sensor probe array; local flow parameter; phase density image; bubble size distribution

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