Numerical Simulation for the Improved Five-Sensor Probe Method by Introducing Correction Factors to Measure the Interfacial Area Concentration

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Abstract

Interfacial area concentration is an important parameter in the two phase flow models, which significantly affects the accuracy of the prediction. Currently, there are three probe methods to measure the interfacial area concentration, which are the double-, four- and five sensor methods. Among them, the four- and five-sensor probe methods can be applied to various flow regimes where the shape of the bubbles is beyond the spherical shape. The five-sensor method was developed to measure the missing bubbles which bypass one or more of the rear sensors more accurately than the other methods. However, for the bubbles having a high lateral velocity, there can be measurement errors since the validity of the assumption for the missing interfaces in the five-sensor method is reduced. In this study, the measurement error is quantified and corrected with factors related to the turbulent intensity based on numerical simulations. The corrected five-sensor method also includes a modification for the small bubbles of which the shape can be considered to be spherical. The bubble parameters related to the bubble motion and geometry are determined by the Monte Carlo approach.