Quantitative assessment of cross-correlation based particle velocity measurement in different gas fluidization regimes

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Abstract

Particle velocity measurement based on cross-correlation algorithm is explored widely in multiphase flow systems. In this study, an optical fiber probe, i.e. Labasys® 100 from MSE Meili was used to systematically investigate the big differences in the measurement quality of cross-correlation particle velocity instrument in fast and bubbling fluidized beds (FFB and BFB). Compared to an FFB, the measured particle velocity data in a BFB show poor data repeatability, higher percentage of invalid data and high sensitivity to the selection of the threshold value of maximum cross-correlation coefficient, corresponding to a much lower measurement quality throughout the bed. High measurement qualities appear in the annulus of the riser and under higher superficial gas velocity. A matchup relationship between the particle velocity measurement quality and the shape of the probability density function (PDF) curves of maximum cross-correlation coefficient is found. Narrower PDF curves correspond to higher measurement quality and vice versa.

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