气泡羽流空隙率的计算及其不稳定规律的研究

Research on the calculation of void fraction of bubble plume and its instability pattern

中文关键词：气泡羽流　空隙率　灰度值　纵横比

英文关键词：bubble plume　void fraction　gray value　aspect ratio

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中文摘要：

　　在气液两相流中，气相和液相各自有不同的流场，而液相的速度场取决于气泡的运动特性。空隙率是气液两相流中描述气泡分散相间相互作用的一个重要的参数，通过对气泡羽流的空隙率分布分析，可了解气泡羽流的运动机理与实验条件之间的关系。本文采用图像处理的方法测量在高密度气泡下的瞬时空隙率分布。对拍摄的图片进行预处理，得到其灰度图像和灰度值，建立其局部灰度值与投影空隙率间的相关关系，进一步计算出气泡羽流的不同位置处的空隙率值分布，在此基础上分析不同工况下空隙率值的分布情况及其对气泡羽流结构的影响。结果表明：该方法适合用于气液两相流空隙率的测量，在纵横比为1.0时，气泡羽流的结构受压强影响小，羽流结构稳定；纵横比为1.5和2.0时，随着压强的增大，羽流结构呈现不稳定。

英文摘要：

　　In bubbly two-phase flow, gas phase and liquid phase have different flow fields, respectively The relative velocity between two phases depends on the motion characteristic of bubbles. The void fraction is a very important parameter to describe the interaction of bubble dispersed phase. The relationship between movement mechanism and the experiment conditions can be obtained by calculation and analysis of the void fraction distribution of the plume bubble. In this study, the void fraction distribution can be obtained in high void fraction by image processing methods. The gray-scale image obtained by PIV and gray value are attained by image pre-processing, and then the correlation and mutual relationship between the locally averaged brightness of the bubble plume images and the real void fraction were obtained. This method was used to calculate void fraction distribution under three different aspect ratios, and the result was used to analyze the impact of the void fraction distribution and the structure of bubble plume in different conditions. It is found that this method is suitable to measure the void fraction of gas-liquid two-phase flow When the aspect ratio is 1.0, the void fraction distribution does not affect the pressure variation and the structure is stability. Whereas, if the aspect ratio is in the range from 1.5 to 2.0, the structure is unstable when the pressure increases.

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