

多相流和计算流体力学

## 用于高浓度气液两相流的成像相关测速技术

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摘要

对一种基于成像的激光相关测速技术进行了理论和实验研究。利用光散射理论模拟了成像测量系统对单个颗粒的光信号响应特点,分析了颗粒粒径和探头直径对信号及其频谱的影响,研究了测量体在光轴方向的有效长度。针对信号特点,研究了信号处理参数,分析了分段相关性计算中窗口宽度对计算结果的影响及其选择依据,并对窗函数和信号预平移等优化方法进行了研究。成功地对一脉冲喷雾爆破区高浓度流场进行了测试,获得了不同脉冲宽度下喷雾速度变化规律和轴向径向分布,测试结果与文献报道结果基本吻合,表明基于成像的相关测速系统可以很好地应用于喷嘴出口附近高浓度流场的测试。

关键词

[激光相关测速](#) [高浓度](#) [气液两相流](#) [喷雾](#) [成像分析](#)

分类号

## Imaging-based correlation velocimetry and its application to dense gas-liquid flow

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### Abstract

Theoretical and experimental studies on an imaging-based correlation velocimetry were presented. The signals received by detectors when a single particle passing through the measurement volume were calculated. The effects of particle size and detector diameter on the signal and its frequency spectrum were studied and the effective length of the measurement volume was analyzed. In data processing, the determination of the length of time window was studied and the methods using windowing functions and data pre-shift were also analyzed. Velocity measurements for the dense region of a spray near the nozzle exit by using the measurement system were successfully carried out. The spray velocity variations under different pulse injections as well as the radial and axial profiles of spray velocities were obtained. The imaging-based correlation velocimetry was proved to be a simple and effective tool for the velocity measurement of the dense gas-liquid flow very close to the nozzle exit.

### Key words

[laser correlation velocimetry](#) [dense](#) [gas-liquid two-phase flow](#) [spray](#) [imaging analysis](#)

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