

Paper 32.1

Turbulence Characteristics in Particle Laden Water Jet Injected Into Water Tank by Means of PDA and PIV

by

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ABSTRACT

Measurement on particle motion and analysis on turbulence modification at the liquid-solid two-phase jet flows were carried out in the paper. The water jet including glass beads of 375 μm in mean diameter was injected into still water bath. To study the particle dispersion near the region of jet outlet, the initial velocity gradient was changed with injection pipe conditions, which had 5 and 8 mm in diameter, with injecting velocities of 1.8 and 1.5m/s, respectively. Firstly, an LDA was applied to measure the particle velocity. The Saffman's lift force and Stokes number based on the time constant of the particle and inverse of the velocity gradient of water were estimated from the experimental results. Figure 1 shows the relationship between the Stokes number and relative velocities between particle and water. Figure 2 shows the Saffman's lift force. Detail discussion about them is presented in this paper. Secondly, particle mass loading was changed to discuss the turbulent modification. The PDA raw data were divided into particle and water velocities. Figure 3 illustrates the variation in turbulent intensity against local mass loadings. The positive correlation can be clearly found in the figure. Finally, a particle image velocimetry (PIV) was used to implement the two-phase flow measurement. To analyse the present flow, two-types of light sources, YAG laser and stroboscope light, were employed. Stroboscope light can only be used for big and small velocity particles' motion because of its poor light intensity. In the contrary, seeding particles data could be obtained by using the YAG double pulse laser. Comparing between PIV and PDA data, it seems that the PIV data with the YAG double pulse laser is close to seeding particle velocities measured by PDA. It is pointed out that the PIV can measure with discrimination of large particles and small seeding particles by changing the light source power.

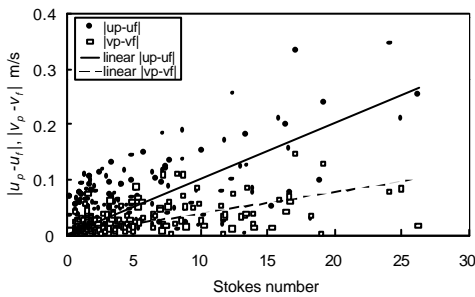


Fig. 1 Relative velocities between particle and water versus Stokes number.

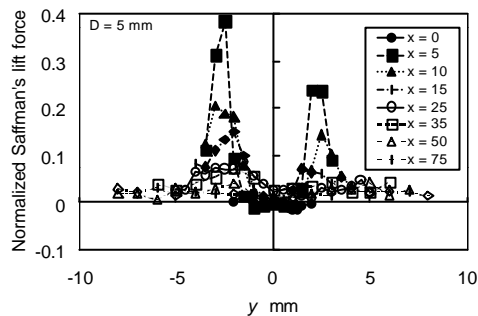


Fig. 2 Distribution of Saffman's lift force.

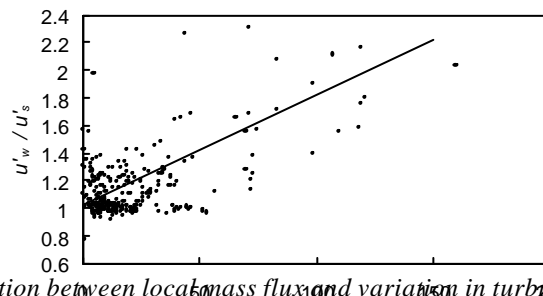


Fig. 3 Correlation between local mass flux and variance in turbulence intensity.

Mass flux $\text{kg/m}^2 \text{s}$

