

Velocity Measurements Technique and Structure Study of High Pressure Water Jet by High Speed LIF-PTV

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ABSTRACT

In recent years, high pressure water jet for the soil improvements is one of the most important applications of water jet under high pressure and high liquid flow rate. The jet pressure reaches up to 30~200MPa and sometimes the jet velocity exceeds the super sonic. In order to improve the efficiency and the performance of jet grouting, it is very important to clarify the hydrodynamic structure of water jet under high pressure and high flow rate. However, the fundamental researches on this subject are quite insufficient both analytically and experimentally because of its technical difficulty. In this study, the velocity measurements technique for capturing the structure of the water jet was investigated. The double pulse Nd:YAG Laser and CCD camera with Image Intensifier were applied to capture clearly a couple of pictures of the high speed water jet. We observed the structure of the water jet by LIF-PTV and measured the velocity of the water jet. As a result, it has been understood that the velocity distribution takes a value close to the speed of the Bernoulli rule. Moreover, the deceleration is almost seen and the cutting ability of the water jet is kept enough in about 1m that is the range of the measurement of the actual experiment without. In addition, the water jet was able to be observed to change from the image of making to visible to the droplet flow at once in the nozzle neighborhood though it was a continuous style.

KEYWORDS

Waterjet, nozzle, CCD camera, PTV, Velocity Measurements

1. CURRENT STATE OF FLOW-SPEED MEASUREMENT OF WATER JET

The water jet is a complex fluxional structure. It rolls or forms the drop of water or undertakes the wind drag or goes with the ambient fluid. Therefore, a fluid mechanics characteristic of the water jet and the finding of the fluxional structure are still limited. However, if the fluxional structure of the water jet is clarified, the nozzle becomes more efficient. It is necessary indispensability to establish the method of evaluating the nozzle, and the progress