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Waterjet Rock Cutting Performance according to the Distance between the Abrasive Particles in the Focusing Tube

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ABSTRACT

Waterjet technology has low noise and vibration and excellent performance. In civil engineering, it is used for rock cutting and concrete demolition. It is also used for tunnel excavation assistance method. However, there is a lack of an approach to cutting performance depending on the complicated mechanism of the waterjet configuration for rock cutting. Therefore, it is necessary to study the performance prediction and system configuration to be used properly in civil engineering. Especially, it is required to study the efficiency of the waterjet considering system configuration such as an orifice nozzle and focusing tube, which has a great influence on the performance. For the focusing tube, it has structural characteristics such as diameter and length. The kinetic energy of the abrasive is influenced by specific gravity and size. The inner diameter and length of the focusing tube determine the inter-abrasive interactions that flow inside, and the collision of the wall and abrasive in the tube. In this study, waterjet performance for rock cutting considering the characteristics of the focusing tube are researched. The cutting performance according to the space volume of one abrasive particle in the focusing tube was experimented. In order to calculate the number of abrasive particle in the focusing tube, equation considering the jet velocity, the abrasive size, and the feed rate is proposed. As a result, the influence of the length and inner diameter of the focusing tube on the cutting performance can be estimated according to the abrasive characteristic and the system configuration parameters. Through this study, the optimal feed rate or optimal focusing tube size can be selected through the effect of focusing tube characteristics on cutting performance for rock cutting. The results of this study are expected to be applied to optimization and operation of waterjet for civil engineering.

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