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Measurement of abrasive particle velocity and size distribution in high pressure abrasive slurry and water micro-jets using a modified dual disc anemometer

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Abstract

In both abrasive water jet (AWJ) and high pressure abrasive slurry jet (HASJ) machining, garnet abrasive particles are mixed with water and the resulting jet can contain particles travelling with a wide range of velocities. Previous investigations have suggested that a dual disc anemometer (DDA) can be used to provide an assessment of the average particle velocity within the jets. This paper presents an in-depth analysis of the DDA test by considering the distribution and size of impact craters on the recording disc, and by modeling the size of the slurry slug incident to it. Procedures are presented to assess the accuracy of the determined average velocity, and to determine the histogram of particle velocities within the jet. A modification to the anemometer is introduced which also allows determination of the particle size-velocity correlation. Results are presented for both HASJ and AWJ under typical process conditions, and compared to existing analytical models of abrasive particle velocity from the literature, with good agreement.

Keywords: abrasive particle velocity, dual disc anemometer, micro-machining, abrasive water jet, abrasive slurry jet