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# Ultrasound Measurement by Laser Doppler Anemometry

P.C.M. Galloway[1], Y. Hardalupas[2] and I. Prassas[2]
[1]DERA Farnborough, UK
[2] Imperial College of Science, Technology and Medicine
Mechanical Engineering Department
Exhibition Road
London SW7 2BX
UK

## ABSTRACT

This paper parametrically examines the influence of frequency and amplitude of ultrasound waves in a frequency range of 100-200kHz on the signals produced by a laser Doppler anemometer, as well as the influence of the path length of interaction between laser beams and ultrasound waves. Neutrally-buoyant particles were suspended in water in a cylindrical tank with 130mm diameter and an LDA system, based on a dual Bragg-cell beam splitter and frequency shifter, was used. A high-speed oscilloscope was used to digitise the Doppler signals and frequency analysis was performed on the signals to produce their power spectra. Because of the high frequency of the ultrasound compared with the response time of the particles, the signals were modulated by the variation of the refractive index due to ultrasound field. This finding was also confirmed by use of a stationary glass-fibre scatterer in the probe of the LDA system. The processed signals showed that the measured signal amplitude increased linearly with increasing ultrasound frequency and ultrasound amplitude, for the range of conditions examined here. In addition, a similar relation was found for signal amplitude as a function of the laser beam path length exposed to ultrasound. Theoretical analysis supports the experimental findings. The results suggest that it is feasible to use a laser Doppler-based instrument for the measurement of amplitude of ultrasound sources, provided that certain design guidelines are followed.