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### A study of turbulence and cyclic variation levels in internal combustion engine cylinders

by

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#### ABSTRACT

This paper describes an experimental investigation of the cyclic variations and instability of the jet flows in the cylinders of dual-intake port gasoline engines under both steady-state and motored engine conditions using laser-Doppler anemometry and spectral analysis techniques.

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Cyclic variations within the cylinder of an internal combustion engine were investigated by comparing cycle-to-cycle variation and turbulence levels of a point near the centre of the cylinder to those of a point within the intake jet. The velocity spectra at these points were also analysed using spectral analysis techniques. Cyclic variation levels have also been shown to broaden the values of turbulence. Figure 1 shows a plot of mean velocity versus crank angle and displacement below a valve with the colour code denoting cyclic variation levels normalised with mean piston speed. It is clear that these levels are higher than 50% of the mean piston speed even near TDC compression.

The instability of the jet flows around the inlet valves was studied under steady state conditions by quantifying the values of skewness and kurtosis.

**Figure 1: Normalised ensemble mean velocities and cyclic variation levels against crank angle and displacement (induction-compression).**

