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PIV Measurements within a Water Analog Engine

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ABSTRACT

Cyclic flow in a water analog engine with two circular valved inlets has been investigated with Particle Image Velocimetry (PIV). A unique triggering and data collection system was developed, allowing a CCD to acquire two consecutive images at a specific crank angle. An optical water analog engine, operating at 15 RPM with a square cross-section and two circular valved inlets was constructed to simulate quasi-periodic non-stationary flow. The mean flow, RMS turbulence velocities, average Reynolds stresses, and average vorticity were determined by ensemble averaging 200 velocity fields at the 2 different measurement locations presented here. It was found that near the valves, there existed high intensity localized mixing while further downstream, the mixing was found to be spatially uniform and not as intense. The RMS turbulent quantities indicated a wider range of velocity closer to the valves than downstream. An adaptive cross correlation and validation PIV algorithm implemented by Usera (1999) was used. This algorithm improved the spatial resolution and the velocity results with respect to standard cross correlation and validation procedure.

Key Words : Turbulence, Cyclic flow, Particle Image Velocimetry(PIV), Mixing