Extension of Laser Diagnostics towards Multi-dimensional and Multi-Parameter (Quantitative) Measurements in Piston Engines

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Abstract

In many engineering applications involving fluid flow, an improved understanding of the system requires the ability to measure and interpret the leading scalar and vector quantities that characterize system performance. Laser-based and other optical diagnostics have provided the ability to resolve the leading sub-processes in reacting and non-reacting flows, including multi-phase flows. Recent advances in such diagnostics have provided the ability to better resolve transient, multi-component, multi-parameter, and three-dimensional information - all with high temporal and spatial resolution.

The presentation will present findings from two different experimental campaigns related to extending diagnostic measurements towards multi-dimensional and multi-component (quantitative) diagnostic measurements inside an optically accessible engine.

(1) The first half of the presentation will focus on extending the applications of particle image velocimetry towards tomographic particle image velocimetry (TPIV) in an IC engine environment. This topic will include the assessment and application of TPIV after fuel injection to study the three-dimensional spray-induced flow field.

(2) The second half of the presentation will focus on applications of simultaneous PIV and laser induced fluorescence (LIF) diagnostics applications to measure the detailed transport of flame propagation in an IC engine

The presentation will also openly identify limitations of the diagnostics at this early stage and identify some of the challenges that remain