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Experimental Investigation of the turbulence-flame interaction using POD based Finite Time Lyapunov Exponents (FTLEs) SINA RAFATI, University of Texas At Austin, NOEL CLEMENS, University of Texas At Ausin — Rare events are defined as the excursions of a dynamical system toward unwanted conditions with possible catastrophic consequences. To that end, the focus of this study is to investigate the interaction of turbulence with a jet flame to better understand the occurrence of rare events in combustion such as flashback, extinction or blowout. Kraichnan (1965) has shown that there is a strong correlation between the existence of rare events and a fluid's memory. As a consequence, the persistence of an initiated perturbation in a dynamical system for time-scales comparable to the large-scale flow time-scales might lead to rare events. In this study, 20 kHz Particle Image Velocimetry (PIV) has been used for velocity measurement of lifted methane-air turbulent flames. Two Coherent Evolution-90 diode-pumped Nd:YLF lasers were used to create 527nm pulses for PIV. The proper orthogonal decomposition (POD) method was utilized to obtain a compact representation of the velocity field. Then, the high-dimensional velocity field was projected into a lower-dimensional space for Lower Order Reconstruction (LOR) of the flow field with the aim of bringing new insight to the contribution of various scales in the chaotic development of the flow. Finally, Lagrangian coherent structures (LCSs) are obtained as ridges of FTLE maps to study the flow topologies as a function of space and time. Our results are representing how LCSs interact with flame as they are approaching to the flame front.

Sina Rafati
University of Texas At Austin

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