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Fast Hydrogen-Air Flames for Turbulence Driven Deflagration to Detonation Transition[1] JESSICA CHAMBERS, Propulsion and Energy Research Laboratory, University of Central Florida, KAREEM AHMED, Propulsion and Energy Research Laboratory University of Central Florida — Flame acceleration to Detonation produces several combustion modes as the Deflagration-to-Detonation Transition (DDT) is initiated, including fast deflagration, auto-ignition, and quasi-detonation. Shock flame interactions and turbulence levels in the reactant mixture drive rapid flame expansion, formation of a leading shockwave and post-shock conditions. An experimental study to characterize the developing shock and flame front behavior of propagating premixed hydrogen-air flames in a square channel is presented. To produce each flame regime, turbulence levels and flame propagation velocity are controlled using perforated plates in several configurations within the experimental facility. High speed optical diagnostics including Schlieren and Particle Image Velocimetry are used to capture the flow field. In-flow pressure measurements acquired post-shock, detail the dynamic changes that occur in the compressed gas directly ahead of the propagating flame. Emphasis on characterizing the turbulent post-shock environment of the various flame regimes helps identify the optimum conditions to initiate the DDT process. The study aims to further the understanding of complex physical mechanisms that drive transient flame conditions for detonation initiation.

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