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Lagrangian Enstrophy Dynamics in Highly Turbulent Premixed Flames RYAN DARRAGH, COLIN TOWERY, Univ of Colorado - Boulder, ALEXEI POLUDNENKO, Texas AM University, PETER HAMLINGTON, Univ of Colorado - Boulder — Turbulent combustion is a multi-scale and multi-physics problem depending upon both chemical and fluid dynamic processes. These processes are often examined using an Eulerian framework, but recently the Lagrangian framework, a long-time tool in non-reacting flow research, has become increasingly common for the study of turbulent combustion. The two analysis frameworks are in fact equivalent, with the only difference being a change in reference frame. In this study, a Lagrangian fluid parcel tracking algorithm is used to analyze the enstrophy (i.e., vorticity magnitude) dynamics in turbulent premixed reacting flows. The analysis of vorticity dynamics in the premixed flame case is based on data from a three dimensional direct numerical simulation of a premixed stoichiometric hydrogen-air flame in an unconfined domain. Enstrophy budget terms are tracked along Lagrangian trajectories as fluid parcels travel through the flame, with particular focus on understanding the dynamical causes of turbulence variations through the flame preheat and reaction zones with respect to both the fluid parcel and the flame. Additionally, the ability of trajectories to completely sample the flame is discussed.

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