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Direct numerical simulations of flow-chemistry interactions in statistically turbulent premixed flames PAUL ARIAS, University of Michigan, HARSHAVARDHANA URANAKAR, SWETAPROVO CHAUDHURI, India Institute of Science, Bangalore, HONG IM, King Abdullah University of Science and Technology — The effects of Damköhler number and Karlovitz number on the flame dynamics of three-dimensional statistically planar turbulent premixed flames are investigated by direct numerical simulation incorporating detailed chemistry and transport for a hydrogen-air mixture. The mean inlet velocity was dynamically adjusted to ensure a stable flame within the computational domain, allowing the investigation of time-averaged quantities of interest. A particular interest was on understanding the effects of turbulence on the displacement speed of the flame relative to the local fluid flow. Results show a linear dependence on the displacement speed as a function of total strain, consistent with earlier work on premixed-laminar flames. Additional analysis on the local flame thickness reveals that the effect of turbulence is twofold: (1) the increase in mixing results in flame thinning due to the enhancement of combustion at early onset of the flame, and (2) for large Reynolds number flows, the penetration of the turbulence far into the preheat zone and into the reaction zone results in localized flame broadening.

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