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Interaction of Thermodiffusive Instabilities and Turbulence in Lean Hydrogen/Air Mixtures using Tabulated Chemistry JASON SCHLUP, GUILLAUME BLANQUART, Caltech — The combustion of lean hydrogen mixtures is prone to thermodiffusive instabilities due to the strongly non-unity fuel Lewis number. Simulations of the combustion process can aid in designing new burners to reduce operating risks associated with thermodiffusive instabilities; however, direct numerical simulations of large scale burners with detailed chemistry mechanisms are prohibitively expensive. The significant simulation time requires that computational costs decrease by using reduced order chemistry and turbulence modeling. In this work, a chemistry table, created with one-dimensional flames, is used to reduce the simulation cost. Direct numerical simulations of turbulent combustion with lean hydrogen/air mixtures are performed. Both statistically planar and spherically expanding flames are considered, and the turbulence level varies from laminar to fully turbulent flow conditions. The chosen equivalence ratio displays thermodiffusive instabilities in the wrinkled flame front. The influence of turbulence intensity on the flame instabilities are explored, and the results are compared to previous studies to determine the adequacy of the tabulated chemistry method for this set of simulation parameters.

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