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Modeling local extinction in turbulent combustion using an embedding method ROBERT KNAUS, CARLOS PANTANO, University of Illinois at Urbana-Champaign — Local regions of extinction in diffusion flames, called "flame holes," can reduce the efficiency of combustion and increase the production of certain pollutants. At sufficiently high speeds, a flame may also be lifted from the rim of the burner to a downstream location that may be stable. These two phenomena share a common underlying mechanism of propagation related to edge-flame dynamics where chemistry and fluid mechanics are equally important. We present a formulation that describes the formation, propagation, and growth of flames holes on the stoichiometric surface using edge flame dynamics. The boundary separating the flame from the quenched region is modeled using a progress variable defined on the moving stoichiometric surface that is embedded in the three-dimensional space using an extension algorithm. This Cartesian problem is solved using a high-order finite-volume WENO method extended to this nonconservative problem. This algorithm can track the dynamics of flame holes in a turbulent reacting-shear layer and model flame liftoff without requiring full chemistry calculations.

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