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An extinction/reignition dynamic method for turbulent combustion ROBERT KNAUS, CARLOS PANTANO, University of Illinois at Urbana-Champaign — Quasi-randomly distributed locations of high strain in turbulent combustion can cause a nonpremixed or partially premixed flame to develop local regions of extinction called "flame holes". The presence and extent of these holes can increase certain pollutants and reduce the amount of fuel burned. Accurately modeling the dynamics of these interacting regions can improve the accuracy of combustion simulations by effectively incorporating finite-rate chemistry effects. In the proposed method, the flame hole state is characterized by a progress variable that nominally exists on the stoichiometric surface. The evolution of this field is governed by a partial-differential equation embedded in the time-dependent two-manifold of the flame surface. This equation includes advection, propagation, and flame hole formation (flame hole healing or collapse is accounted by propagation naturally). We present a computational algorithm that solves this equation by embedding it in the usual three-dimensional space. A piece-wise parabolic WENO scheme combined with a compression algorithm are used to evolve the flame hole progress variable. A key aspect of the method is the extension of the surface data to the three-dimensional space in an efficient manner. We present results of this method applied to canonical turbulent combusting flows where the flame holes interact and describe their statistics.

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