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Lagrangian and Eulerian PDF Simulations of Nonpremixed Turbulent Flames with Moderate-to-Strong Turbulence/Chemistry Interactions[1] J. JAISHREE, D.C. HAWORTH, The Pennsylvania State University
— Transported probability density function (PDF) methods offer compelling advantages for modeling chemically reacting turbulent flows, and Lagrangian particle-based Monte Carlo algorithms have become the predominant method for solving modeled PDF transport equations. Significant progress has been made in Lagrangian particle methods to facilitate their implementation into conventional Eulerian computational fluid dynamics (CFD) codes. Still, it would be desirable to realize the advantages of PDF methods using more conventional numerical algorithms and/or at lower computational cost. Toward these ends, Eulerian field methods have been proposed as alternatives to particle-based methods for solving modeled PDF transport equations. Here we apply Lagrangian particle and Eulerian field (both stochastic and deterministic) PDF methods to a hierarchy of three piloted methane-air nonpremixed turbulent jet flames where turbulence/chemistry interactions become progressively more important. Both accuracy and computational efficiency are assessed. Based on these results, we provide recommendations on how to apply each method most effectively, and we identify outstanding issues requiring future research.

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