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Effects of Heat Loss and Subgrid-Scale Models on Large Eddy Simulations of a Premixed Jet Combustor Using Flamelet-Generated Manifolds FRANCISCO E. HERNANDEZ PEREZ, BOK JIK LEE, HONG G. IM, King Abdullah University of Science and Technology, ALESSIO FANCELLO, ANDREA DONINI, JEROEN A. VAN OIJEN, L. PHILIP H. DE GOEY, Eindhoven University of Technology — Large eddy simulations (LES) of a turbulent premixed jet flame in a confined chamber are performed using the flamelet-generated manifold technique for tabulation of chemical kinetics and the OpenFOAM framework for computational fluid dynamics. The configuration is characterized by an off-center nozzle having an inner diameter of 10 mm, feeding a lean methane-air mixture with an equivalence ratio of 0.71 and mean velocity of 90 m/s, at 573 K and atmospheric pressure. Conductive heat loss is accounted for in the manifold via burner-stabilized flamelets and the subgrid-scale (SGS) turbulence-chemistry interaction is modeled via presumed filtered density functions. The effects of heat loss inclusion as well as SGS modeling for both the SGS stresses and SGS variance of progress variable on the numerical predictions are all systematically investigated. Comparisons between numerical results and measured data show a considerable improvement in the prediction of temperature when heat losses are incorporated into the manifold, as compared to the adiabatic one. In addition, further improvements in the LES predictions are achieved by employing SGS models based on transport equations.

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