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Modeling of Unsteady Heat Transfer in Flame-Wall Interaction HAO WU, MATTHIAS IHME, Stanford University — An extension of the flamelet/progress variable model is developed to include wall-heat loss effects due to convective heat-transfer. The model introduces a source term in the unsteady flamelet equations, which is modeled based on a modified temperature boundary condition of the counter-flow diffusion flame configuration. The thermochemical composition of the resulting non-adiabatic flamelet structure forms a three-dimensional manifold, which is parameterized in terms of mixture fraction, temperature, and scalar dissipation rate. The performance of the model is evaluated in an a priori study of a H_2/O_2 diffusion flame that is stabilized at an inert isothermal wall. Comparisons with DNS-data show that the developed non-adiabatic flamelet model accurately represents conditional and unconditional results for temperature, chemical composition, and wall heat transfer. Following this a priori investigation, the model is applied in LES of a coaxial H_2/O_2 rocket injector, and simulation results from this a posteriori analysis will be compared with experimental data.

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