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An Inadequacy Formulation for an Uncertain Flamelet Model DAVID SONDAK, TODD OLIVER, CHRIS SIMMONS, ROBERT MOSER, University of Texas at Austin — We report progress on the development of an uncertain flamelet library for use in non-premixed turbulent combustion. A stochastic inadequacy operator is generalized from previous work and is now used to incorporate uncertainties in chemical reaction mechanisms in a flamelet model. The original form of the inadequacy operator was designed to enforce positivity of chemical species concentrations and conservation of species while representing inadequacies in reduced chemical mechanisms. As a first step towards generalization, we are exploring temperature dependent modifications to the inadequacy operator. The temperature dependence helps ensure that the operator is inactive in the absence of chemical reactions and becomes active only after ignition. A Bayesian inverse problem is used to calibrate the stochastic operator on a hydrogen-oxygen zero-dimensional reactor and to infer model parameters, and their uncertainties, from data obtained via a detailed chemical mechanism. The inferred model parameters are then propagated through a laminar, non-premixed, counterflow hydrogen-oxygen flame. Temperature and species profiles at various scalar dissipation rates are compared to those predicted from a five-reaction reduced model and the detailed model.

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