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Quantification of the uncertainties in the prediction of extinction of hydrogen-air diffusion flames NICOLAS KSEIB, Mechanical Engineering Department, Stanford Unversity, JAVIER URZAY, GIANLUCA IACCARINO, Center for Turbulence Research, Stanford University — The study of the physical processes that lead to extinction of flames in gaseous hydrogen-air non-premixed combustion is of paramount importance for the reliable design of power plants and advanced propulsion systems in automobiles and hypersonic aircrafts. However, there remain several uncertainties in the experimental quantification of reaction rates of elementary steps in most of hydrogen-air mechanisms, which can produce hazards in hydrogen manipulation and engine malfunction. In this study, the effects of aleatory uncertainties in the chemical reaction-rate constants induced in hydrogen-air counterflow diffusion-flame extinction processes are addressed, with a probabilistic representation of the uncertain parameters sampled with a Markov-Chain Monte Carlo algorithm. Measurements of the reaction-rate constants and their associated uncertainty factors, reported earlier for the Stanford hydrogen-air detailed chemical mechanism, are used to study the propagation of uncertainties in the calculation of scalar dissipation rates at extinction. Non-intrusive methods are used to analyze the variablities, with the probability density function of the scalar dissipation rate being sampled around regions involving flame extinction and global sensitivity indices being computed by Monte Carlo sampling.

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