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Numerical simulations of turbulent jet ignition and combustion ABDOULAHAD VALIDI, ABOLFAZL IRANNEJAD, FARHAD JABERI, Michigan State University — The ignition and combustion of a homogeneous lean hydrogen-air mixture by a turbulent jet flow of hot combustion products injected into a colder gas mixture are studied by a high fidelity numerical model. Turbulent jet ignition can be considered as an efficient method for starting and controlling the reaction in homogeneously charged combustion systems used in advanced internal combustion and gas turbine engines. In this work, we study in details the physics of turbulent jet ignition in a fundamental flow configuration. The flow and combustion are modeled with the hybrid large eddy simulation/filtered mass density function (LES/FMDF) approach, in which the filtered form the compressible Navier-Stokes equations are solved with a high-order finite difference scheme for the turbulent velocity and the FMDF transport equations are solved with a Lagrangian stochastic method to obtain the scalar (temperature and species mass fractions) field. The hydrogen oxidation is described by a detailed reaction mechanism with 37 elementary reactions and 9 species.

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