Abstract Submitted
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LES/FMDF of turbulent jet ignition in a rapid compression machine ABDOULAHAD VALIDI, HAROLD SCHOCK, ELISA TOULSON, FARHAD JABERI, Michigan State University, CFD AND ENGINE RESEARCH LABS, MICHIGAN STATE UNIVERSITY COLLABORATION — Turbulent Jet Ignition (TJI) is an efficient method for initiating and controlling combustion in combustion systems, e.g. internal combustion engines. It enables combustion in ultra-lean mixtures by utilizing hot product turbulent jets emerging from a pre-chamber combustor as the ignition source for the main combustion chamber. Here, we study the TJI-assisted ignition and combustion of lean methane-air mixtures in a Rapid Compression Machine (RCM) for various flow/combustion conditions with the hybrid large eddy simulation/filtered mass density function (LES/FMDF) computational model. In the LES/FMDF model, the filtered form of compressible Navier-Stokes equations are solved with a high-order finite difference scheme for the turbulent velocity, while the FMDF transport equation is solved with a Lagrangian stochastic method to obtain the scalar (species mass fraction and temperature) field. The LES/FMDF data are used to study the physics of TJI and combustion in RCM. The results show the very complex behavior of the reacting flow and the flame structure in the pre-chamber and RCM.

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