Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

DNS and LES/FMDF of turbulent jet ignition and combustion
ABDOULAHAD VALIDI, FARHAD JABERI, Michigan State University — The ignition and combustion of lean fuel-air mixtures by a turbulent jet flow of hot combustion products injected into various geometries are studied by high fidelity numerical models. Turbulent jet ignition (TJI) is an efficient method for starting and controlling the combustion in complex propulsion systems and engines. The TJI and combustion of hydrogen and propane in various flow configurations are simulated with the direct numerical simulation (DNS) and the hybrid large eddy simulation/filtered mass density function (LES/FMDF) models. In the LES/FMDF model, the filtered form of the compressible Navier-Stokes equations are solved with a high-order finite difference scheme for the turbulent velocity and the FMDF transport equation is solved with a Lagrangian stochastic method to obtain the scalar field. The DNS and LES/FMDF data are used to study the physics of TJI and combustion for different turbulent jet igniter and gas mixture conditions. The results show the very complex and different behavior of the turbulence and the flame structure at different jet equivalence ratios.

AbdoulAhad Validi
Michigan State University

Date submitted: 29 Jul 2014 Electronic form version 1.4