Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Large Eddy Simulations of turbulent flames using two-dimensional reduced-order manifold models ALEX G. NOVOSELOV, CRISTIAN E. LACEY, MICHAEL E. MUELLER, Princeton University — Recently, we have developed a set of two-dimensional manifold equations describing multi-modal combustion using the mixture fraction and a generalized progress variable. Information about the underlying mode of combustion is encoded in three scalar dissipation rates that appear as parameters in the two-dimensional equations. In this work, Large Eddy Simulations (LES) of turbulent hydrogen flames in both the asymptotic limits of combustion (i.e. nonpremixed and premixed) and multi-modal flames are performed using this new turbulent combustion model. These simulations are compared to LES performed using traditional one-dimensional manifold-based turbulent combustion models as well as experimental measurements. The new model is shown to describe the flames in the asymptotic limits just as well as the one-dimensional models but without any *a priori* knowledge of the flame necessary to select the model. Additionally, the new model is shown to be able to describe the behavior of multi-modal turbulent flames where traditional one-dimensional models fail.

Alex G. Novoselov
Princeton University

Date submitted: 25 Jul 2019 Electronic form version 1.4