Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Numerical Study of Flame Stabilization Mechanism in a Premixed Burner with LES Non-adiabatic Flamelet Approach YIHAO TANG, MALIK HASSANALY, VENKAT RAMAN, Department of Aerospace Engineering, University of Michigan — In the development of highly efficient gas turbine combustion system, using high-hydrogen-content fuels is a new solution that limits pollutant emissions but also triggers flame stabilization issues. One promising concept to handle such instabilities within a large range of operating conditions is the FLOX® burner. A noticeable feature of the FLOX® burner is that it discharges high momentum jets without swirl, and flame stabilization is achieved in the shear layer around the jets. Experimental investigations have concluded that low velocity zones were absent and the flashback propensity was effectively decreased. It is proposed to study the stabilization mechanism to understand what physical phenomena are decisive in the process. In a preliminary numerical study, an adiabatic flamelet table was used along with LES simulations. Although the flow field's main features were captured, the simulation had issues in accurately predicting some important thermochemical quantities, including near wall quenching effects and OH mass fraction distribution. This work focuses on the effect of the adiabatic hypothesis on the flame stabilization mechanism. A non-adiabatic flamelet model is implemented and the impact on the stabilization mechanism is being quantified.

Yihao Tang
Department of Aerospace Engineering, University of Michigan

Date submitted: 01 Aug 2015 Electronic form version 1.4