Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Simulation of Reacting Flow with a Discontinuous Spectral Element Method ZIA GHIASI, FARZAD MASHAYEK, JONATHAN KOMPERDA, University of Illinois at Chicago — While using high order methods is desirable in order to accurately capture the small scale mixing effects in reacting flows, the challenge is to develop and implement such methods for complex geometries. In this work, a high-order Discontinuous Spectral Element Method (DSEM) code, which solves for the Navier-Stokes equations, has been modified by adding the appropriate components to solve for scalar transport equations in order to simulate the chemical reaction. Dealing with discontinuous solution at element interfaces is a challenge that is met by patching the fluxes at mortars thus making them continuous on interfaces. The patching is performed using the Lax-Fredrichs numerical flux for scalars, whereas a generalized Riemann solver is used for the Navier-Stokes equations. Direct numerical simulation is conducted in a temporally developing mixing layer to validate the method for a single step reaction ($F + rO \rightarrow [1 + r]P$). Next, the method is implemented to simulate a subsonic reacting flow in a slanted cavity combustor with gaseous fuel injectors to demonstrate the capability of the method to handle complex geometries. The results will be used for physical understanding of mixing and reaction in this type of combustors.

Farzad Mashayek
University of Illinois at Chicago

Date submitted: 23 Jul 2013 Electronic form version 1.4