Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Bivariate chemistry model for the simulation of high Karlovitz premixed turbulent flames in the absence of differential diffusion BRUNO SAVARD, GUILLAUME BLANQUART, California Institute of Technology — In recent work (Savard et al., Proc. Comb. Inst. (2014)), it was shown that the structure, i.e. the dependence of the species mass fractions on temperature, of a high Karlovitz n-heptane/air turbulent premixed flame was similar to that of an unstretched one-dimensional flame in the absence of differential diffusion. The mean profiles of the species chemical source terms conditional to temperature were also found to be very close to those of a corresponding unstretched one-dimensional flame. However, while minimal deviation from the one-dimensional solution was found in the flame structure, large relative fluctuations around the mean (close to the one-dimensional solution) were found in the species source terms. Accordingly, conventional tabulated chemistry with only one progress variable transported is shown to adequately represent the flame structure and the mean species source terms, but not the source terms fluctuations. In this work, a bivariate chemistry model (i.e. a model based on two variables) that captures these species source terms fluctuations is presented. The model is first developed for unity Lewis number flames, but an extension to flames with differential diffusion is discussed.

Bruno Savard
California Institute of Technology

Date submitted: 01 Aug 2014 Electronic form version 1.4