Combustion Energy Frontier Research Center

Post-Doctoral Position in

Direct Numerical Simulations of Low-Dimensional Reacting Flows

The Combustion EFRC seeks outstanding applicants for the position of post-doctoral research associate to perform research at the University of Southern California and the Sandia National Laboratories on multi-dimensional simulations of a number of experimental configurations.

The development of detailed kinetic models describing the pyrolysis and oxidation of fuels depends heavily on experimental data that are determined in either zero- or one-dimensional configurations. The advantage is that testing models can be done rather efficiently in those low-dimensional flows. The computational cost involved in two or three dimensions renders the simulations prohibitively expensive from a model development point of view. Examples of low-dimensional experimental configurations include static/flow/perfectly-stirred reactors, shock tubes, rapid compression machines, stagnation-type flames, and spherically expanding flames in constant pressure or constant volume environments. While extensive efforts have been spent over the last few decades to conform such experiments to the basic assumptions of the attendant modeling, still outstanding questions remain regarding the validity of the underlying assumptions, and more importantly, on the effects of potential higher-dimensional effects on model development and the propagation of such effects eventually into large-scale simulations.

The project involves high-fidelity simulations of a selected set of configurations using a detailed description of chemical kinetics and molecular transport. Several configurations will be assessed including, among others, stagnation-type flames and spherically expanding flames at constant pressure, using a compressible direct numerical simulation (DNS) solver with detailed chemistry developed at Sandia. In all cases, higher-dimensional effects will be quantified in detail. The DNS will be used to understand the underlying flow field and the time-dependent behavior of flame propagation as well as limit phenomena such as extinction and ignition over a range of thermo-chemical conditions and fuel chemistry. The successful applicant will be based at the University of Southern California in the research group of Professor Fokion N. Egolfopoulos, but will spend approximately one-half time at Sandia’s Combustion Research Facility in the group of Dr. Jacqueline Chen. The very large computer resources of the Department of Energy will be available to the project through an INCITE award.

The position is to start September 1, 2009 (or soon thereafter), and the appointment is expected to be for at least two years. Interested applicants should e-mail Prof. Egolfopoulos (egolfopo@usc.edu) or Dr. Chen (jhchen@sandia.gov) attaching their CV and providing the names of two or three references.