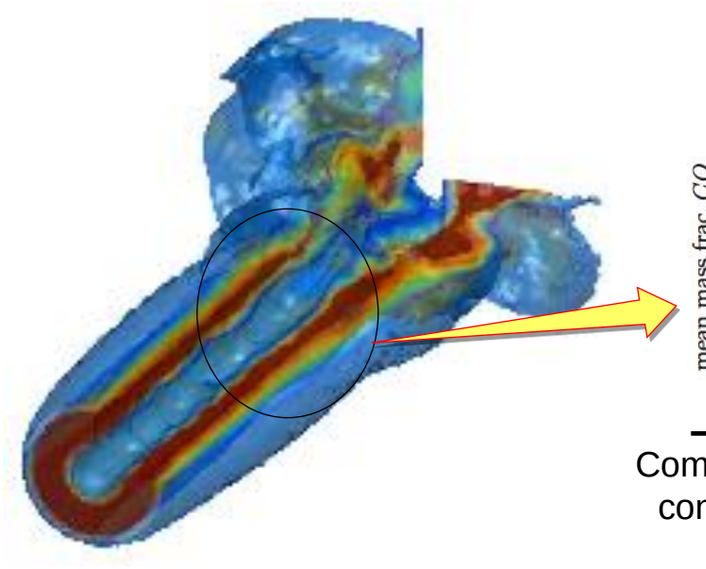
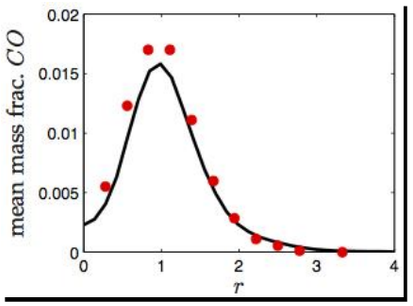
Large-Scale Simulation of Turbulent Flames with Detailed Chemistry

Reza H. Sheikhi, Department of Mechanical and Industrial Engineering, Northeastern University

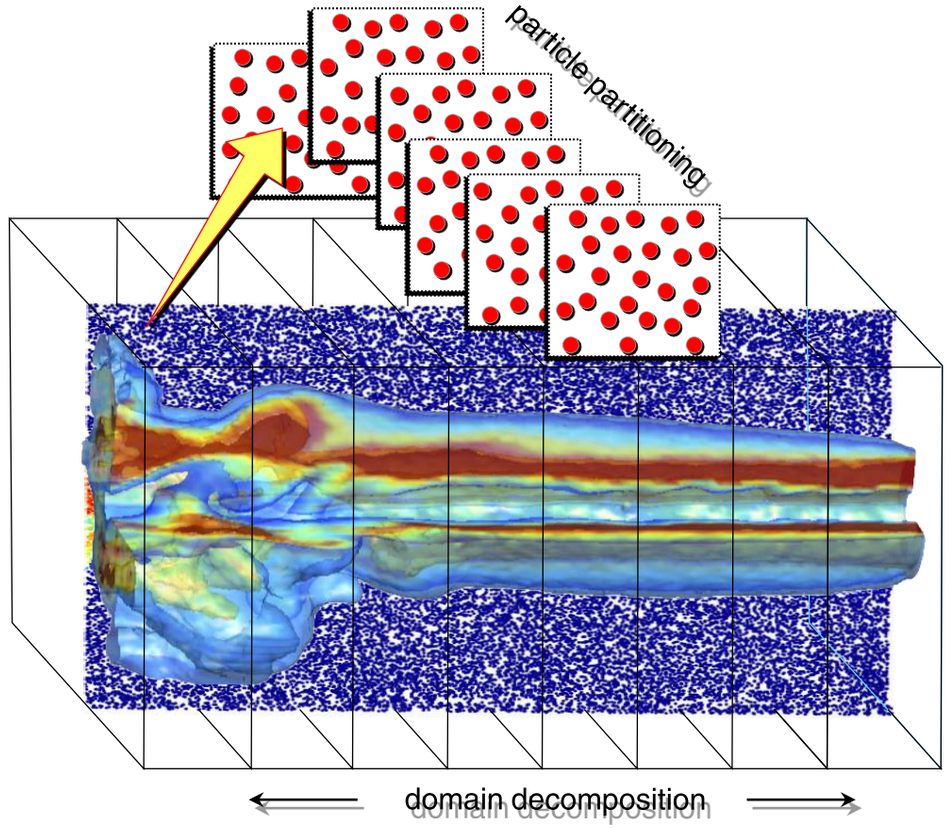
- The main objectives of this research are to perform *realistic* simulation of turbulent reacting flows and to gain further insight into their underlying physical processes. These objectives are achieved by conducting large eddy simulation (LES) of these flows along with efficient representation of complex chemical kinetics on massively parallel platforms. The subgrid scale effects are accounted for via the filtered density function (FDF) methodology. Several methods are considered to implement the chemical kinetics including:
  - Direct integration using efficient stiff ordinary differential equation solvers.
  - Rate-Controlled Constrained-Equilibrium (RCCE) method.
- A hybrid domain decomposition/particle partitioning algorithm is developed for efficient parallelism of FDF on large number of processors.



Flame structure predicted in turbulent nonpremixed jet flame (Sandia flame F) simulations



Comparison of carbon monoxide concentration predictions with experimental data



Implementation of LES/FDF on massively parallel architectures using hybrid domain decomposition/particle partitioning

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