**Progress and Challenges in Modeling Turbulent Combustion**

Joseph C. Oefelein, Guilhem Lacaze, and Layal Hakim

Sandia National Laboratories  
CaliforniaP.O. Box 969  
Livermore  
CA 94551-0969  
Phone: (925) 294-2648  
E-mail: [oefelei@sandia.gov](mailto:oefelei@sandia.gov)

**Abstract**

Turbulent combustion in propulsion and power systems involves a variety of multiphysics processes such as high-Reynolds-number turbulence, high-pressure mixed-mode combustion, oxidation of complex fuels, and multiphase flow. The multiscale nature of the problem imposes many challenges that hinder development of predictive models. This seminar will focus on these challenges and present progress toward the development and validation of advanced combustion models. A central focal point will be on the application of the Large Eddy Simulation (LES) technique with emphasis on: (1) formation of collaborative links between experiments and simulations, (2) development of advanced theoretical-numerical capabilities, and (3) maximizing the use of high-performance massively-parallel computing. Progress in each area will be illustrated through a progressive sequence of examples, including recent studies of turbulent jet flames and high-pressure supercritical fuel injection processes.