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Scalar Filtered Density Function for Large Eddy Simulation of a Bunsen Burner[1] S. LEVENT YILMAZ, PEYMAN GIVI, National Energy Technology Laboratory, WV and University of Pittsburgh, Department of Mechanical Engineering and Material Science, PETER STRAKEY, National Energy Technology Laboratory, Morgantown, WV — The scalar filtered density function (SFDF) methodology is extended for large eddy simulation (LES) of a turbulent, stoichiometric premixed methane/air flame. The SFDF takes account of subgrid scales (SGS) by considering the mass weighted probability density function (PDF) of the SGS scalar quantities. A transport equation is derived for the SFDF in which the effects of chemical reactions appear in closed form. The SGS mixing is modeled via the linear mean square estimation (LMSE) model, and the convective fluxes are modeled via a SGS viscosity. The modeled SFDF transport equation is solved by a hybrid finite-difference/Monte Carlo scheme. A novel irregular domain decomposition procedure is employed for scalable parallelization which facilitates affordable simulations with realistic chemical reactions and flow parameters. Oxidation chemistry is modeled via a 5-step reduced, and a 15-step augmented reduced mechanism. Results are presented of the mean and rms values of the velocity, the temperature, and mass fractions of the major and the minor species. These results are assessed by comparison against laboratory data.

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