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Filtered Density Function for Large Eddy Simulation of Local Entropy Generation in Turbulent Reacting Flows MEHDI SAFARI, M. REZA H. SHEIKHI, Northeastern University — Analysis of local entropy generation is an effective means to investigate sources of efficiency loss in turbulent combustion from the standpoint of the second law of thermodynamics. A methodology, termed the "entropy filtered density function" (En-FDF), is developed for large eddy simulation (LES) of turbulent reacting flows to include the transport of entropy. The filtered form of entropy transport equation contains several unclosed entropy generation terms that contribute to efficiency losses in turbulent combustion. The closure is provided by the En-FDF, which embodies the complete statistical information about entropy variations within the subgrid scale. An exact transport equation is developed for the En-FDF. The unclosed terms in this equation are modeled by considering a system of stochastic differential equations. The modeled En-FDF transport equation is solved by a Lagrangian Monte Carlo method. The En-FDF is applied to a turbulent shear layer and validated by comparing with results obtained from direct numerical simulation of the same layer. The methodology is also employed to study local entropy generation in turbulent flames. The results are compared with the experimental data.

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