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Large Eddy Simulation of Entropy Generation in a Turbulent Mixing Layer REZA H. SHEIKHI, MEHDI SAFARI, FATEMEH HADI, Northeastern University — Entropy transport equation is considered in large eddy simulation (LES) of turbulent flows. The irreversible entropy generation in this equation provides a more general description of subgrid scale (SGS) dissipation due to heat conduction, mass diffusion and viscosity effects. A new methodology is developed, termed the entropy filtered density function (En-FDF), to account for all individual entropy generation effects in turbulent flows. The En-FDF represents the joint probability density function of entropy, frequency, velocity and scalar fields within the SGS. An exact transport equation is developed for the En-FDF, which is modeled by a system of stochastic differential equations, incorporating the second law of thermodynamics. The modeled En-FDF transport equation is solved by a Lagrangian Monte Carlo method. The methodology is employed to simulate a turbulent mixing layer involving transport of passive scalars and entropy. Various modes of entropy generation are obtained from the En-FDF and analyzed. Predictions are assessed against data generated by direct numerical simulation (DNS). The En-FDF predictions are in good agreements with the DNS data.

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