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Large Eddy Simulation of a Supercritical Turbulent Mixing Layer[1] REZA SHEIKHI, Dena Scientific, FATEMEH HADI, Tennessee State University, MEHDI SAFARI, Fairfield University — Supercritical turbulent flows are relevant to a wide range of applications such as supercritical power cycles, gas turbine combustors, rocket propulsion and internal combustion engines. Large eddy simulation (LES) analysis of such flows involves solving mass, momentum, energy and scalar transport equations with inclusion of generalized diffusion fluxes. These equations are combined with a real gas equation of state and the corresponding thermodynamic mixture variables. Subgrid scale models are needed for not only the conventional convective terms but also the additional high pressure effects arising due to the nonlinearity associated with generalized diffusion fluxes and real gas equation of state. In this study, LES is carried out to study the high pressure turbulent mixing of methane with carbon dioxide in a temporally developing mixing layer under supercritical condition. LES results are assessed by comparing with data obtained from direct numerical simulation (DNS) of the same layer. LES predictions agree favorably with DNS data and represent several key supercritical turbulent flow features such as high density gradient regions.

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