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Direct numerical simulation of supersonic combustion with finite-rate chemistry[1] AMIRREZA SAGHAFIAN, HEINZ PITSCH, Stanford University — Three-dimensional direct numerical simulations (DNS) of reacting and inert compressible turbulent mixing layers have been performed. The simulations cover convective Mach numbers from subsonic to supersonic. A detailed chemistry mechanism with 9 species and 29 reactions for hydrogen is used in the reacting simulations. Effects of different initial conditions on the structure of the mixing layer, and time required to reach self-similarity are studied. Flame/turbulence interaction is analyzed by studying turbulent kinetic energy, Reynolds stresses, and their budgets in the reacting and inert simulations. The effects of different reactions on the heat release and mixture composition especially in the regions where shocklets impinge the flame are studied. These DNS databases will provide a better understanding for the compressibility effects on the combustion, and will be used to assess the accuracy of Flamelet/Progress variable approach in supersonic regime.

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Amirreza Saghafian
Stanford University

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