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Simulation of Scramjet Fuel Injection Using a Hybrid RANS/LES Approach DAVID PETERSON, GRAHAM CANDLER, University of Minnesota — A methodology is presented for the simulation of realistic scramjet combustor sections at actual operating conditions. A flow solver with an unstructured grid framework is used such that grids can be constructed for complex geometries. Numerics are chosen for robustness and reliability, while not being overly dissipative as to overwhelm the actual flow physics. The flow around a scramjet fuel injector is highly unsteady and dominated by coherent, large-scale structures. The goal is to be able to capture the key physics of the flow field, without resolving all of the detail of the flow. In regions of the flow where unsteady phenomenon are important, such as where mixing occurs or in massively separated regions, LES is used. RANS is used in regions of attached flow, such as boundary layers, where RANS performs well. In addition, RANS is also used as a wall model for the LES regions of the flow. This allows for realistic Reynolds number to be simulated at reasonable cost. Comparisons are made between simulations and available experimental data.

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