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Results from flamelet and non-flamelet models for supersonic combustion FOLUSO LADEINDE, Stony Brook University, WENHAI LI, TTC Technologies, Inc. — Air-breathing propulsion systems (scramjets) have been identified as a viable alternative to rocket engines for improved efficiency. A scramjet engine, which operates at flight Mach numbers around 7 or above, is characterized by the existence of supersonic flow conditions in the combustor. In a dual-mode scramjet, this phenomenon is possible because of the relatively low value of the equivalence ratio and high stagnation temperature, which, together, inhibits thermal choking downstream of transverse injectors. The flamelet method has been our choice for turbulence-combustion interaction modeling and we have extended the basic approach in several dimensions, with a focus on the way the pressure and progress variable are modeled. Improved results have been obtained. We have also examined non-flamelet models, including laminar chemistry (QL), eddy dissipation concept (EDC), and partially-stirred reactor (PaSR). The pressure/progress variable-corrected simulations give better results compared with the original model, with reaction rates that are lower than those from EDC and PaSR. In general, QL tends to over-predict the reaction rate for the supersonic combustion problems investigated in our work.

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