Numerical and Experimental Investigation of a Central Strut Injector with Perpendicular Injection for Scramjet Applications

K. Makowka⋆, M. Gurtner⋆⋆, D. Paukner⋆⋆, T. Sattelmayer⋆ and H. Kau⋆⋆
⋆Institute for Thermodynamics, Technische Universität München, Germany
Boltzmannstr. 15, 85748 Garching, Germany
⋆⋆Institute for Flight Propulsion, Technische Universität München, Germany
Boltzmannstr. 15, 85748 Garching, Germany

Abstract

Scramjet propulsion systems need an injection system with an adequate fuel penetration depth. Within this context, numerical simulations and an associated supersonic injection experiment are conducted in order to investigate the effect of perpendicular fuel injection on the shock boundary layer interaction at the opposing wall. Carbon dioxide is injected into a continuous air crossflow at Mach 1.9. Simulations are conducted with a density-based, explicit method employing the Kurganov and Tadmor central flux scheme. Numerical results are confronted with experimental wall pressure data and Schlieren images. Results show that the application of a wall function boundary layer model instead of a boundary layer resolving mesh is legitimate.