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HEAT TRANSFER MANAGEMENT BY AEROSPIKES FOR A HYPOTHESIZED LIFTING BODY IN HYPERSONIC FLOW

Abstract

The elevated drag and convective heating associated with hypersonic speeds have a significant impact on the design considerations of vehicles. To alienate this problem, literature review proclaims the use of aerospikes, as passive flow control technique, conducted only on simple axisymmetric geometries and not on representative lifting body shapes. As a first-of-its-kind fundamental study, the efforts were focused on the analysis of using forward-facing aerospikes and gauging its thermal effectiveness with varying angle of attack (0 deg to +10 deg), spike-nose configuration and characteristic spike lengths, on key phenomena of heat reduction for prospective application to a hypothesized lifting-body configuration forming a delta shape with non-axisymmetric forward stagnation surface, and thereby assessing the feasibility prospects for futuristics applications. The experiments were performed in the High Temperature and High Enthalpy Hypersonic Wind Tunnel at University of Tokyo, Kashiwa Campus; on models manufactured from Bakelite material using Rapid Prototyping Machine (Roland MDX 540-A). Flow visualization was done using the recorded schlieren pictures. Measurements, from two-dimensional temperature distribution generated by an installed InfraRed camera, at freestream Mach 7 revealed that 1) significant reduction of locally heat-concentrated zones from body nose to small area of spike nose, 2) provides an understanding about the reattachment of entropy layer over the shoulder region of forebody whose location can be controlled by appropriately selecting the type of aerospike (suitable nose-type and geometric parameters), 3) and; thereby indicating their worthiness towards practical feasibility for eventual future applications to high-speed vehicles from thermodynamic point of view. The full-length poster will incorporate the detailed heat transfer coefficient comparison results with respect to the geometric parameters of aerospike considered with that of no-spike case.