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AERODYNAMIC PERFORMANCE ANALYSIS OF AN UNMANNED RE-ENTRY VEHICLE FROM HYPERSONIC DOWN TO SUBSONIC REGIME

Abstract

This paper deals with the aerodynamic performance analysis of a winged unmanned re-entry vehicle from Hypersonic down to subsonic regime. To this end both engineering-based and CFD design methods have been considered to assess vehicle aerodynamics characteristics for flight mechanics and thermo-mechanics design purposes. Such a vehicle shall re-enter the atmosphere allowing to perform a number of experiments on critical re-entry technologies. Indeed, thermo-chemical non-equilibrium CFD simulations are performed at several discrete points of the re-entry trajectory according to the trajectory-based design approach. The range between Mach 2 and Mach 25 was analyzed. In the present analysis rarefied and continuum regime (supersonic and hypersonic speed ranges) with the air modeled as a mixture of five and/or eleven species has been studied. A summary review of the aerodynamic characteristics of the vehicle concept is performed and reported in the paper. An analysis of the longitudinal and lateral-directional stability has been also provided. In the paper some of the main interesting flowfield features obtained for the concept vehicle are shown.