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INVESTIGATION OF HEATSHIELD SHAPE CHANGES ON OPTIMUM AERODYNAMIC DESIGN FOR A MARS ENTRY CAPSULE

Abstract

Heatshield shape of a Mars entry capsule predominately determines the aerodynamic characteristics of the capsule. For a typical passive ballistic Mars entry flight, the capsule relies solely on aerodynamic stability to traverse all of the flight regimes. Therefore, heatshield shape selection is the key factor for optimum aerodynamic design of the capsule. In the present study, two types of heatshield shapes, i.e., sphere-cone and spherical dish, are investigated by numerical simulation. For each type of heatshield shape, parametric study of the key geometric parameter is conducted to determine the optimum value in terms of drag characteristics and aerodynamic stabilities. Comparison of aerodynamic characteristics between the two types of heatshield shape is made and the sphere-cone shape shows advantageous performance over the spherical dish shape. The mechanisms of the heatshield shape changes effects on the aerodynamic characteristics of the capsule are analyzed based on the flow field information obtained by numerical simulations.