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AERODYNAMIC DESIGN OF A CAPSULE CONFIGURATION FOR HIGH-SPEED MANNED RE-ENTRY

Abstract

Aerodynamic configuration of the capsule for manned re-entry at the second cosmic speed requires a relatively higher lift-to-drag ratio compared to the configuration for manned re-entry at the first cosmic speed. The present capsule configurations with high lift-to-drag ratio, for instance, the Apollo and the Orion, have secondary statically stable trim points, which is highly undesirable since it would cause disastrous result once the vehicle flies at the secondary trim point during re-entry. In the present study, effective design methodology for improving the monostability characteristics of re-entry capsules without compromising the lift-to-drag ratio is revealed based on flow field characteristics analysis. As a result, aerodynamic configuration design of a capsule with high lift-to-drag ratio and monostable characteristics is proposed. And the aerodynamic characteristics of the capsule ranging from subsonic to hypersonic speed are predicted by numerical simulations.