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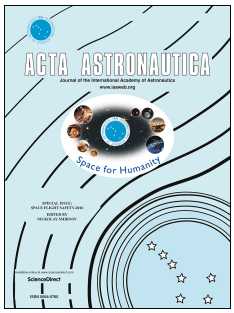

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Evolved Atmospheric Entry Corridor with Safety Factor

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Abstract:

Atmospheric entry corridors are established in previous research based on the equilibrium glide condition which assumes the flight-path angle to be zero. To get a better understanding of the highly constrained entry flight, an evolved entry corridor that considers the exact flight-path angle is developed in this study. Firstly, the conventional corridor in the altitude vs. velocity plane is extended into a three-dimensional one in the space of altitude, velocity, and flight-path angle. The three-dimensional corridor is generated by a series of constraint boxes. Then, based on a simple mapping method, an evolved two-dimensional entry corridor with safety factor is obtained. The safety factor is defined to describe the flexibility of the flight-path angle for a state within the corridor. Finally, the evolved entry corridor is simulated for the Space Shuttle and the Common Aero Vehicle (CAV) to demonstrate the effectiveness of the corridor generation approach. Compared with the conventional corridor, the evolved corridor is much wider and provides additional information. Therefore, the evolved corridor would benefit more to the entry trajectory design and analysis.

Keywords: Atmospheric entry; flight constraint; evolved entry corridor; three-dimensional corridor; safety factor

1. Introduction

During an atmospheric entry, multiple constraints need to be satisfied. In general, the path constraints are expressed as boundaries of a flight corridor, and the vehicle's trajectory should be

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