Paper ID: 28394
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ASTRODYNAMICS SYMPOSIUM (C1)
Interactive Presentations (IP)

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CONSTRAINTS HANDLING METHOD IN INDIRECT TRAJECTORY OPTIMIZATION FOR MANNED ASTEROID EXPLORATION

Abstract

Manned asteroid exploration has several different constraints compared with unmanned exploration. For instance, the time should not be too long to ensure plenty food and water supply. Besides, after landing on the asteroid, the explorer should stay a time to complete certain tasks before leaving. At the same time, mass changing such as discarding of garbage and releasing of scientific devices should be considered. Therefore these constraints need be properly treated when designing and optimizing the explorer's trajectory. In this paper based on indirect method, a time-fuel hybrid optimal problem is established, in which the constraint on mass to supply astronauts' living is transformed to constraints on fly time. The constraint on stay time required after landing is transformed to a special states jumping. By applying homotopic method with a new guessing strategy of co-states, the whole problem can be well solved. At last, a simulation example of manned asteroid exploration mission is provided. The result proves practicability and effectiveness of our algorithm.