Paper ID: 35257
student

SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations (IP)

Author: Ms. Ying Lei
Beijing Institude of technology, China, ying_lei@bit.edu.cn

Dr. Ai Gao
Beijing Institute of Technology, China, gaoai@bit.edu.cn
Prof. Cui Pingyuan
School of Astronautics Science and Technology, Beijing Institute of Technology, China, cuipy@bit.edu.cn

A NOVEL GUIDANCE ALGORITHM FOR PLANETARY PROXIMITY OPERATIONS WITH OBSERVABILITY CONSTRAINTS

Abstract

The navigation and guidance algorithm of proximity operations is important for the planetary exploration and defense. Because of the low accuracy of the traditional navigation method based on DSN, the development of the real-time and autonomous navigation and guidance system has gained attentions in recent years. The visual-based autonomous navigation and guidance method has been widely used for proximity operations with the rapid development of computer vision technique. However, the limitation of this approach is that the performance of observability is affected significantly by the relative motion between the spacecraft and the planet. By optimizing the relative motion trajectory with observability, the estimation accuracy can be improved efficiently. Therefore, a navigation and guidance algorithm based on the observability constraints for planetary proximity operations is proposed, which can improve the navigation accuracy and overall navigation and guidance system performance. In this paper, the observability of the visual-based navigation system for planetary proximity operations is discussed, as a constraint to optimize the observation trajectory. The gravity model of the planet is incorporated in order to resolve the problem of uncertainty of gravitational field around the planet. The results from the mathematical simulation show that the proposed guidance algorithms based on observability constraints can improve the overall performance of navigation and guidance control system effectively compared with the traditional guidance algorithms.