IAF SPACE OPERATIONS SYMPOSIUM (B6)
Ground Operations - Systems and Solutions (1)

Author: Mr. Shahin Abdullayev
Azercosmos, Space Agency of Republic of Azerbaijan, Azerbaijan, shahin.abdullayev.89@gmail.com

ALGORITHMS AND DATA STRUCTURES IN SPACE TECHNOLOGIES

Abstract

Algorithms and data structures play a vital role in the progress of space technologies, allowing for real-time decision-making and complex problem-solving. They are also essential for storing and analyzing the vast volumes of data produced by space missions. Mission planning for spacecraft trajectory optimization often involves the use of linear, integer, and nonlinear programming algorithms, which can reduce fuel consumption and ensure that the spacecraft arrives at its destination on schedule and within budget, while satisfying various physical and operational constraints.

This article provides a thorough overview of latest advancements in the application of linear, integer, and nonlinear programming algorithms in spacecraft mission planning to optimize trajectory. The article begins by introducing the fundamental concepts of these three algorithms, followed by an overview of the physical and operational constraints involved in spacecraft trajectory optimization. It then presents a literature review of recent and older studies that have employed these programming methods to spacecraft mission planning, including a discussion of different modeling approaches, optimization algorithms, and constraints employed.

The review highlights the importance of accurately modeling the spacecraft's dynamics and accounting for uncertainties and disturbances. It also identifies the effectiveness of different optimization algorithms, such as the interior-point method, simplex method, and branch and bound algorithm. For readers who are unfamiliar with these technical terms, brief explanations have been provided.

In summary, algorithms and data structures are crucial components in the advancement of space technologies, and their application in spacecraft mission planning is of significant importance. This review has presented the current state-of-the-art in the application of linear, integer, and nonlinear programming algorithms in spacecraft mission planning to optimize trajectory and has identified several research directions for future study.