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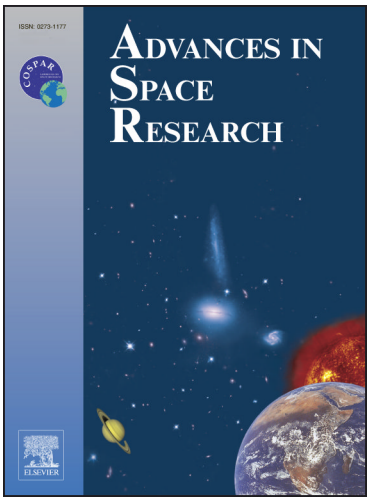

Mission planning for on-orbit servicing through multiple servicing satellites: A new approach

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Mission planning for on-orbit servicing through multiple servicing satellites: A new approach

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Abstract

In this paper, a novel approach is proposed for the mission planning of on-orbit servicing such as visual inspection, active debris removal and refueling through multiple servicing satellites (SSs). The scheduling has been done with the aim of minimization of fuel consumption and mission duration. So a multi-objective optimization problem is dealt with here which is solved by employing particle swarm optimization algorithm. Also, Taguchi technique is employed for robust design of effective parameters of optimization problem. The day that the SSs have to leave parking orbit, transfer duration between parking orbit and final orbit, transfer duration between one target to another, and time spent for the SS on each target are the decision parameters which are obtained from the optimization problem. The raised idea is that in addition to the aforementioned decision parameters, eccentricity and inclination related to the initial orbit and also phase difference between the SSs on the initial orbit are identified by means of optimization problem, so that the designer has not much role on determining them. Furthermore, it is considered that the SS and the target rendezvous at the servicing point and the SS does not perform any phasing maneuver to reach the target. It should be noted that Lambert theorem is used for determination of the transfer orbit. The results show that the proposed approach reduces the fuel consumption and the mission duration significantly in comparison with the conventional approaches.

Keyword: on-orbit servicing, mission planning, Lambert targeting problem, multiple servicing satellites, bi-objective optimization, Taguchi method.

1. Introduction

Nowadays on-orbit servicing due to its particular importance has attracted the attention of many researchers. The on-orbit servicing not only increases the life time and the systems performance

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