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A NOVEL MISSION SCHEDULING ALGORITHM FOR LARGE-SCALE GEOSYNCHRONOUS ORBIT SPACECRAFT REFUELING PROBLEM

Abstract

Spacecraft refueling is crucial in constructing on-orbit service (OOS) systems, large-scale geosynchronous orbit (GEO) spacecraft refueling problem is exhibiting broad application prospect with the increasing number of space launch missions. However, it is difficult for existing mission scheduling algorithms to solve the problem due to the slow convergence and easy falling into local optima in the huge search space generated by the increasing number of spacecraft. To address this issue, this paper proposes a locality sensitive hash clustering based genetic algorithm (LSH-GA). Firstly, the spacecraft refueling scheme combining "a fixed Fuel station (FS) + round-trip servicing spacecraft (RSS)" is adopted, and the mission scheduling optimization problem is formulated to minimize the total propellant consumption by exploring the optimal mission allocation and refueling sequences. Secondly, the locality sensitive hashing clustering method (LSH) is employed to build the optimal refueling mission allocation sets, and the optimal refueling sequence in each set is obtained through the genetic algorithm (GA). Moreover, the branch and bound (BB) method is introduced to reorganize each allocation set to obtain the global optimal refueling sequence and orbital maneuvering parameters. Finally, experimental results on various real-world numerical simulations demonstrate the effectiveness and superiority of the proposed LSH-GA in solving large-scale GEO refueling mission scheduling with up to hundreds of targets.