Paper ID: 49794
student

IAF EARTH OBSERVATION SYMPOSIUM (B1)
Interactive Presentations - IAF EARTH OBSERVATION SYMPOSIUM (IP)

Author: Mrs. Lili Ren
National Key Laboratory of Aerospace Flight Dynamics,Northwestern Polytechnical University,Xi'an,, China

Prof. Xin Ning
National Key Laboratory of Aerospace Flight Dynamics, Northwestern Polytechnical University, Xi'an, China
Mr. Shichao Ma
National Key Laboratory of Aerospace Flight Dynamics, Northwestern Polytechnical University, Xi'an, China
Prof. Yuan Jianping
National Key Laboratory of Aerospace Flight Dynamics,Northwestern Polytechnical University,Xi'an, China

HEURISTIC SCHEDULING FOR MULTI-AGILE SATELLITE BASED ON ADAPTIVE GENETIC ALGORITHM

Abstract

As a highly combinatorial optimization problem, multi Agile Earth Observing Satellites(AEOS) scheduling has been proven an NP-hard problem. For one aspect, the scheduling process must under many constraints, such as satellite energy constraints, time constraints, and cloud cover. By the increasing stereo observation requirements, we find few multi AEOS scheduling models consider it. In this paper, we constructed a much detailed model including stereo imaging. For another, the three degrees freedom of agile satellite causes the solution space of AEOS scheduling grows exponentially compared with traditional EOS scheduling problems. So, it is necessary to cut the solution space reasonably. Furthermore, many AEOS scheduling method searches the whole solution space for optimal solution. Then this paper proposes a fast solution method which integrates heuristic operators with adaptive genetic algorithm. This method is divided into three steps. The first step is to select an AEOS for each mission based on the total observed collision time heuristic operator. The second step is to determine a visual time window for each observation task based on the equal opportunity heuristic operator. The selected time window should satisfy the requirement of stereo imaging time. If conflicting tasks exists, they will be temporarily placed in the repository then wait to be arranged again. The third and most critical step is to determine the starting observation time in the visible time window of each observation task. The method used here is an adaptive genetic algorithm and the process are as follows, after several evolutionary processes combined with the proportional selection operator, the weak solution space is deleted, and the same population size searches in the strong solution space, so that the individual density of the powerful solution space increases, which reduces the total evolution generations and is conducive to the generation of the optimal solution. We assume that each observation task has a priority, and our goal consists of three parts: improve completion rate of the overall task, make the image quality as good as possible, and maximize the total benefits. Through different task scale simulation, the results show the model with stereo imaging factor is feasible, contrast with branch and bound algorithm and traditional genetic algorithm this method is effectiveness and efficiency .