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DEVELOPMENT OF SCHEDULING ALGORITHM AND GUI FOR THE AUTONOMOUS SATELLITE MISSION OPERATION

Abstract

The satellites performed simple missions and the total amount of missions was not large in the earlier space era. However, the range and purpose of satellite application are very varying as satellites and application skills are regarded as economic objects. These changes mean that it requires more specific consideration and computation for the satellite mission execution scheduling. For the efficient satellite mission accomplishment, it is necessary to research and develop an optimization algorithm that makes an optimal satellite mission schedule. However, mission scheduling is very complicated due to many mission parameters and constraints, and it also does not have any certain dynamic model to optimize. The genetic algorithm (GA), one of evolutionary algorithm, is applied to solve satellite mission scheduling problems in this paper.

A genetic algorithm is based on natural selection, the process that drives biological evolution. The genetic algorithm repeatedly modifies a population of individual solutions. This algorithm selects individuals at random from the current population as the parents and uses them to produce the children for the next generation at each step. The fitness function, alternative name of the cost function in GA, is constituted with scheduling parameters and weighting factors.

The developed scheduling algorithm is applied to several scheduling problems which reflect the satellite mission scheduling. As uploaded missions are performed, the remaining missions in the mission stack will be considered again in the next scheduling procedures. New missions, which users or customers requested while the satellite accomplishes uploaded missions, are also added and will be considered together. The developed scheduling algorithm is applied to perform this cycle of scheduling automatically.

After the verification of the developed scheduling algorithm, the Graphic User Interface (GUI) is designed. When the GUI is designed, the wideness in its application range and the convenience in modification are considered in a first priority. It helps one can understand the scheduling algorithm directly and use the developed scheduling algorithm easily.

A scheduling optimization algorithm and GUI are developed for autonomous satellite mission operation in this paper. It is expected that the scheduling optimization algorithm and the GUI can reduce the human error and improve the overall efficiency in the satellite mission operation.