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EFFECTIVE MULTIPLE RENDEZVOUS CONSIDERING MODIFIED SPACE DEBRIS INDEX

Abstract

It is common recognition to remove multiple large space debris in a year to avoid exponential increase of fragments and deterioration of orbital environment. However it is expensive and ineffective to launch lots of satellites for removal, hence multiple rendezvous and disposal method using one satellite is required. This paper shows a way of effective choice of multiple space debris considering modified space debris index. Firstly all space debris are propagated for next one hundred year with an orbital simulator. In calculating their orbital position, the simulator estimates their cumulative collision probabilities simultaneously, and finally works out their total potential performances to generate breakup fragments (it is called Modified Space Debris Indices). A general-purpose graphics processing units and fast orbital propagating theory using time averaging method are used for shortening the computational time. Secondly candidates of removal debris are selected considering total velocity increments and the modified space debris indices using genetic algorithm. In computing genetic algorithm, orbital perturbations are also taken into account. We investigated three kinds of method (Simple GA, Elite Recombination and Minimal Generation Gap) for solving Lambert problem (Battin's method) and multiple rendezvous, and the most effective way was adopted for finding quasi-optimal solution. The results of calculated modified space debris indices and some examples of found multiple rendezvous way will be shown.