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MINIMAX MODEL OF TRANSPORT OPERATIONS OF EMERGENCY ON-ORBIT SERVICING IN HELIOSYNCHRONOUS ORBITS

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Heliosynchronous orbits are attractive for space system construction. As a result, the number of spacecraft operating therein is constantly increasing. To increase their efficiency, timely on-orbit servicing (both scheduled and emergency) is needed. Emergency on-orbit servicing of spacecraft is needed in the case of unforeseen, emergency situations with them. According to available statistical estimates, emergency situations with serviced spacecraft are not frequent. Because of this, serviced spacecraft must be within the reach of a service spacecraft for a long time. In planning emergency on-orbit servicing, the following limitations must be met: the time it takes the service spacecraft to approach any of the serviced spacecraft must not exceed its allowable value, and the service spacecraft's allowable energy consumption must not be exceeded. This paper addresses the problem of searching for emergency on-orbit servicing that would be allowable in terms of time and energy limitations and would meet technical and economical constraints. The aim of this work is to develop a mathematical constrained optimization model for phasing orbit parameter choice, whose use would allow one to minimize the maximum time of transport operations in emergency on-orbit servicing of a spacecraft group in the region of heliosynchronous orbits. The problem is solved by constrained minimax optimization. What is new is the formulation of a minimax (guaranteeing) criterion for choosing phasing orbit parameters that minimize the maximum time of emergency on-orbit servicing transport operations. In the minimax approach, the problem is formulated as the problem of searching for the best solution such that the result is certain to be attained for any allowable sets of indeterminate factors. The proposed mathematical model may be used in planning emergency on-orbit service operations to minimize the maximum duration of emergency on-orbit servicing transport operations due to a special choice of the service spacecraft phasing and parking orbit parameters.

Keywords: reusable spacecraft, minimax optimization, parking orbit, on-orbit-servicing.

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