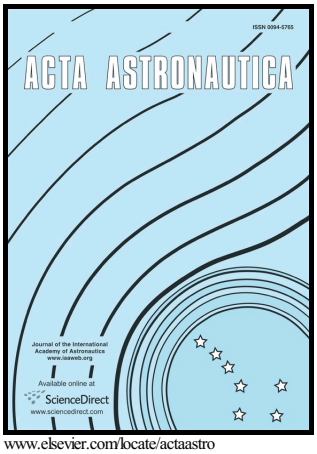

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Flexible Operation Strategy for Environment Control System in Abnormal Supply Power Condition

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Abstract: This paper establishes an optimization method that can be applied to the flexible operation of the environment control system in an abnormal supply power condition. A proposed conception of lifespan is used to evaluate the depletion time of the non-regenerative substance. The optimization objective function is to maximize the lifespans. The optimization variables are the allocated powers of subsystems. The improved Non-dominated Sorting Genetic Algorithm is adopted to obtain the pareto optimization frontier with the constraints of the cabin environmental parameters and the adjustable operating parameters of the subsystems. Based on the same importance of objective functions, the preferred power allocation of subsystems can be optimized. Then the corresponding running parameters of subsystems can be determined to ensure the maximum lifespans. A long-duration space station with three astronauts is used to show the implementation of the proposed optimization method. Three different CO_2 partial pressure levels are taken into consideration in this study. The optimization results show that the proposed optimization method can obtain the preferred power allocation for the subsystems when the supply power is at a less-than-nominal value. The method can be applied to the autonomous control for the emergency response of the environment control system.

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