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Quality and safety, a challenge for traditional and new space (1)

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RESEARCH ON SPACECRAFT PERFORMANCE DEGRADATION BASED ON TELEMETRY DATA

Abstract

With the vigorous development of space industry, the number of on orbit spacecraft is increasing year by year. Its high control precision, more working mode and high complexity have brought great challenges to the ground management. From normal to failure, spacecraft usually undergo a long period of performance degradation. If we can detect the degradation degree of spacecraft performance and evaluate the current operation state of spacecraft, we can adjust its working state to prevent the failure of spacecraft. As a new analytical method, performance degradation analysis is an important way to detect the degree of degradation of performance, and it also provides a new way for life prediction of high reliability products. A lot of telemetry data have been generated in the process of spacecraft monitoring and management, and the increasing data contains important information of the performance degradation of spacecraft, and it is urgent to further explore and analyze it. Based on the large data of spacecraft and the theory and technology of statistical and data mining, this paper has carried out in-depth research on the method of spacecraft performance degradation analysis. First, the development of performance degradation analysis technology, data mining technology related to big data, and performance degradation analysis and prediction of spacecraft are analyzed. Secondly, the modeling and evaluation method of the performance reliability of momentum wheel based on Gamma process is proposed for the failure mechanism of momentum wheel lubrication.The performance degradation process model of lubricant consumption is established by using physical test data of momentum wheel failure. The moment estimation and maximum likelihood estimation of model parameter estimation are given, and the method of calculating the first arrival time of Gamma process is given. On this basis, the reliability of a momentum wheel is evaluated. The example analysis shows that the reliability modeling and evaluation based on the degenerate reliability can solve the reliability evaluation for the long life products of the small and no failure cases of long life products, such as momentum wheel.