Paper ID: 66166
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IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Interactive Presentations - IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (IP)

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A METHOD OF FAULT DIAGNOSIS WITH MIXED INDEX BASED ON PROBABILITY STATISTICS ANALYSIS

Abstract

Recently, SpaceX has been planned to launch the Starlink space-based Internet system, with a total of nearly 42,000 satellites in orbit. And the other companies have also announced the intention to launch thousands more satellites in the next few years. The communication and operation of huge satellite network in near earth space will be faced with the problem of large number of satellites and frequent switching, especially due to environmental factors such as numerous space debris and electromagnetic interference, the failure of satellite system will often occur. Therefore, in order to ensure the smooth operation and implementation of the satellite networking system, it is necessary to analyze and diagnose the telemetry data of near-earth satellites so as to find out the source of faults in time and avoid additional loss. In this paper, based on the multivariable coupled telemetry data of a satellite system, a fault diagnosis method with mixed index as the evaluation criteria is proposed. And the composite variation of the sample vector in the projection space and the principal component space is introduced as the discriminant basis for fault detection. In addition, in order to determine the source of multivariate-data fault, the fault isolation and diagnosis are successfully realized by combining the fault detection discrimination basis and the contribution of different telemetry data to fault determination. Finally, the fault probability of different data sources is determined by calculating the fault contribution rate of the data to the statistics in different principal component space so as to realize the fault isolation and diagnosis of the data driven multivariate coupled telemetry data. By combining the advantages of the residual distribution index and standard deviation distribution index in Bayesian distribution, the mixed index method can not only solve the problem of misjudging the fault source by a single index, but also improve the efficiency and accuracy of complex data diagnosis. The simulation results also show that this method is an effective data-driven fault diagnosis method by manually injecting different types of telemetry data from a certain satellite network.