

SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)  
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FAULT DETECTION METHOD COMBINED RESIDUAL CHI-SQUARE AND IMPROVED SPRT  
ALGORITHM FOR INTEGRATED NAVIGATION SYSTEM**Abstract**

An effective integrated navigation system can provide accurate navigation information. When one or more navigation equipment malfunction, it must be able to locate the faulty subsystem quickly and accurately as well as isolate and reconstruct the system. So the fault detection and isolation are very important for improving the accuracy and reliability of the navigation system. An integrated fault detection algorithm is proposed in this paper to identify multiple types of failure in the integrated navigation system. The fault information of the sensor can be divided into three types: soft failures, hard failures and outliers. In this paper, chi square-improved SPRT algorithm with moving detection cycle is put forward to accomplish the integrated detection of these three kinds of faults. For soft or hard fault detection, the residual chi-square algorithm directly reflects the difference between the system measurement noise and the failure, so it is sensitive to fault which acts directly on the measurements. Traditional SPRT fault detection method delayed fault detection time, reduced real time capabilities and could not determine the fault end time. Aiming at the defects of the two algorithms, this paper presents an integrated fault detection algorithm with higher detection sensitivity for soft fault. And if the residual chi-square algorithm determines the fault ends, the improved SPRT algorithm detection value is corrected in a timely manner. As a result, the improved SPRT algorithm can still detect faults after the first time. Besides, the moving detection cycle is set to the integrated fault detection algorithm. According to the logic of the moving detection cycle, if the majority of detection values exceed the detection threshold in a detection period, failure has occurred and the faulty subsystem will be isolated. If detection values exceed the threshold just a few times, outliers should be considered and the measurements will be reconstructed. The simulation results show that this integrated algorithm can detect outliers effectively and has good detecting effect for soft fault and step fault. Therefore, this integrated algorithm can effectively improve the ability and sensitivity of the system fault detection and enhance the reliability of the integrated navigation system.