

Modeling and Analysis of Navigation Signal Failure Caused by On-board Atomic Clock Anomalies

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In GNSS, the atomic clock is the core part of satellite payloads, which provides the time reference for generating and measuring the navigation signal, consequently its performance has a direct effect on the accuracy of positioning and timing. The failure model of navigation signal generation caused by atomic clock anomalies is the basis for assessing the navigation signal quality and studying the approach of satellite autonomous integrity monitoring (SAIM). This paper first analyzes the atomic clock anomalies and establishes the clock signal model, then details the principles of the on-board time-frequency system. According to the flow of navigation signal generation, the effects of atomic clock anomalies on digital and analog generation parts are studied. Meanwhile we establish the failure transfer model from on-board atomic clock anomalies to navigation signal generation. Finally, mathematical simulation and SAIM test platform experiment results show that the provided model is verified.