

## **A Robust and Adaptive Unscented Kalman Filter for the Air Fine Alignment of the Strapdown Inertial Navigation System/GPS**

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**Abstract :** Adapting to the flexibility of war, a large number of guided weapons launch from aircraft. Therefore, the inertial navigation system loaded in the weapon needs to undergo an alignment process in the air. This article proposes the following methods to the problem of inaccurate modeling of the system under large misalignment angles, the accuracy reduction of filtering caused by outliers, and the noise changes in GPS signals: first, considering the large misalignment errors of Strapdown Inertial Navigation System (SINS)/GPS, a more accurate model is made rather than to make a small-angle approximation, and the Unscented Kalman Filter (UKF) algorithms are used to estimate the state; then, taking into account the impact of GPS noise changes on the fine alignment algorithm, the innovation adaptive filtering algorithm is introduced to estimate the GPS's noise in real-time; at the same time, in order to improve the anti-interference ability of the air fine alignment algorithm, a robust filtering algorithm based on outlier detection is combined with the air fine alignment algorithm to improve the robustness of the algorithm. The algorithm can improve the alignment accuracy and robustness under interference conditions, which is verified by simulation.

**Keywords :** air alignment, fine alignment, inertial navigation system, integrated navigation system, UKF

**Conference Title :** ICISS 2021 : International Conference on Inertial Sensors and Systems

**Conference Location :** Sydney, Australia

**Conference Dates :** February 25-26, 2021