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Design of Enhanced Adaptive Filter for Integrated Navigation System of FOG-SINS and Star Tracker

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Abstract : The fiber optics gyroscope in the strap-down inertial navigation system (FOG-SINS) suffers from precision degradation due to the influence of random errors. In this work, an enhanced Allan variance (AV) stochastic modeling method combined with discrete wavelet transform (DWT) for signal denoising is implemented to estimate the random process in the FOG signal. Furthermore, we devise a measurement-based iterative adaptive Sage-Husa nonlinear filter with augmented states to integrate a star tracker sensor with SINS. The proposed filter adapts the measurement noise covariance matrix based on the available data. Moreover, the enhanced stochastic modeling scheme is invested in tuning the process noise covariance matrix and the augmented state Gauss-Markov process parameters. Finally, the effectiveness of the proposed filter is investigated by employing the collected data in laboratory conditions. The result shows the filter's improved accuracy in comparison with the conventional Kalman filter (CKF).

Keywords : inertial navigation, adaptive filtering, star tracker, FOG
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