INS Aiding with Scalar Measurements of RF Anomalies

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Outline
- A navigation filter is developed which uses received interference power as a navigation signal to aid an INS
- The filter demonstrates sub 0.1% of distance travelled position errors in simulation and upcoming results on real flight data will be presented

Abstract

The modern navigation environment contains multitudes of RF signal sources as wireless communications systems expand across the RF spectrum. As a result, anomalous signals often creep into the bandwidth of common navigation signal systems such as GPS and local RF beacons. This interference reduces the ability of navigation systems to accurately track intended signals and reduces their overall accuracy and robustness. In this work we present a navigation filter which treats the total anomalous signal power (RSSI) as a navigation signal to aid an inertial navigation system (INS). This anomalous signal power is detected using a robust software receiver. External software is used to generate high-definition signal power maps using information about the RF sources and the surrounding terrain. Assuming an initial hypothesis for the RF anomalies in an area, the filter correlates RSSI measurements to the hypothesis map using an error-state marginalized particle filter. The filter demonstrates sub-200m positioning errors (RMSE) in simulation on trajectories of up to 150km.