A New Formulation of Aircraft System Equations for Applying an Extended Kalman Filter

The classic formulation of the aircraft system equations required for implementing an extended Kalman filter (EKF) is derived under the assumption that the wind speed is time-invariant or changing at an extremely slow rate. Therefore, non-zero mean time-varying wind speed can not be estimated using that form of aircraft system description. This paper is aimed at general izing the formulation of the aircraft system equations required for an EKF, and attention is paid to estimating non-zero mean time-varying wind speeds. Flight test data generated using a nonlinear aerodynamic model of a Cessna Citation II aircraft were used to validate the new form augmented system equations which are developed for the purpose of aircraft state estimation taking into account possible wind turbulence. Preliminary results demonstrated the correctness of the new form aircraft system descriptions required for an EKF.