

Integrated Navigation System Using Simplified Kalman Filter Algorithm

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Abstract : GPS and inertial navigation system (INS) have complementary qualities that make them ideal use for sensor fusion. The limitations of GPS include occasional high noise content, outages when satellite signals are blocked, interference and low bandwidth. The strengths of GPS include its long-term stability and its capacity to function as a stand-alone navigation system. In contrast, INS is not subject to interference or outages, have high bandwidth and good short-term noise characteristics, but have long-term drift errors and require external information for initialization. A combined system of GPS and INS subsystems can exhibit the robustness, higher bandwidth and better noise characteristics of the inertial system with the long-term stability of GPS. The most common estimation algorithm used in integrated INS/GPS is the Kalman Filter (KF). KF is able to take advantages of these characteristics to provide a common integrated navigation implementation with performance superior to that of either subsystem (GPS or INS). This paper presents a simplified KF algorithm for land vehicle navigation application. In this integration scheme, the GPS derived positions and velocities are used as the update measurements for the INS derived PVA. The KF error state vector in this case includes the navigation parameters as well as the accelerometer and gyroscope error states.

Keywords : GPS, INS, Kalman filter, inertial navigation system

Conference Title : ICAMAME 2014 : International Conference on Aerospace, Mechanical, Automotive and Materials Engineering

Conference Location : Istanbul, Türkiye

Conference Dates : June 19-20, 2014