عنوان مقاله:

GPS/INS Integration for Vehicle Navigation based on INS Error Analysis in Kalman Filtering

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خلاصه مقاله:

The Global Positioning System (GPS) and an Inertial Navigation System (INS) are two basic navigation systems. Due to their complementary characters in many aspects, a GPS/INS integrated navigation system has been a hot research topic in the recent decade. The Micro Electrical Mechanical Sensors (MEMS) successfully solved the problems of price, size and weight with the traditional INS. Therefore they are commonly applied in GPS/INS integrated systems. The biggest problem of MEMS is the large sensor errors, which rapidly degrade the navigation performance in an exponential speed. Three levels of GPS/IMU integration structures, i.e. loose, tight and ultra tight GPS/IMU navigation, are proposed by researchers. The loose integration principles are given with detailed equations as well as the basic INS navigation principles. The Extended Kalman Filter (EKF) is introduced as the basic data fusion algorithm, which is also the core of the whole navigation system to be presented. The kinematic constraints of land vehicle navigation, i.e. velocity constraint and height constraint, are presented. A detailed implementation process of the GPS/IMU integration system is given. Based on the system model, we show the propagation of position standard errors with the tight integration structure under different scenarios. A real test with loose integration structure is carried out, and the EKF performances as well as the physical constraints are analyzed in detail.

کلمات کلیدی:

GPS/INS Integration, Vehicle Navigation, INS Error Analysis, Kalman Filtering.