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GPS/INS INTEGRATED NAVIGATION SYSTEM FOR PRECISE NAVIGATION OF HIGH
DYNAMIC AERO VEHICLES

Abstract

The GPS(Global Positioning System) receiver has become a commonly used navigation for aircraft precision approaches, missile systems, automated vehicle guidance, and other applications. In order to improve the accuracy, carrier phase measurement is essential in these applications. However, highly dynamic of vehicles may result in cycle slip since carrier phase tracking loop is sensitive to dynamics of vehicles. For a continuous carrier phase measurements, a wide bandwidth of loop is desirable to reduce the effect of dynamic of vehicles. However, it deteriorates the phase jitter due to thermal noise. On the other hand, a narrow bandwidth of loop reduces the phase jitter due to thermal noise. However, it degrades the capability of tracking loops and may result in cycle slips. This paper presents integration method of GPS and INS(Inertial Navigation System) for precise navigation of high dynamic vehicles. In order to utilize accurate carrier phase measurements, velocity information of INS is used in the phase tracking loop and provides capability of robust phase tracking. Even though the velocity aiding improves the performance of phase tracking, the cycle slip can be occurred since velocity information of INS is not perfect. When the cycle slip occurs, the cycle slip should be detected to prevent degradation of performance of integration filter. By using time difference phase measurement and INS information, the cycle slip can be detected within one cycle. Due to the velocity aiding and cycle slip detection method using INS information, the accuracy and integrity of navigation system is improved greatly. The performance of proposed method is evaluated through computer simulation.