Abstract

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Innovation: Cycle Slips Detection and Correction Using Inertial Aiding

GPS carrier-phase measurements can be used to achieve very precise positioning solutions. Carrier-phase measurements are much more precise than pseudorange measurements, but they are ambiguous by an integer number of cycles. When these ambiguities are resolved, sub centimeter levels of positioning can be achieved. However, in real-time kinematic applications, GPS signals could be lost temporarily because of various disturbing factors such as blockage by trees, buildings, and bridges and by vehicle dynamics. Such signal loss causes a discontinuity of the integer number of cycles in the measured carrier phase, known as a cycle slip. Consequently, the integer counter is reinitialized, meaning that the integer ambiguities become unknown again. In this event, ambiguities need to be resolved once more to resume the precise positioning and navigation process. This is a computation-intensive and time-consuming task. Typically, it takes at least a few minutes to resolve the ambiguities. The ambiguity resolution is even more challenging in real-time navigation due to receiver dynamics and the time sensitive nature of the required kinematic solution. Therefore, it would save effort and time if we could detect and estimate the size of these cycle slips and correct the measurements accordingly instead of resorting to a new ambiguity resolution. The cause of cycle slips and present a procedure for detecting and correcting cycle slips using a tightly coupled GPS/ inertial system, which could be used in real time. We will also discuss practical tests of the procedure.