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RAIL INTEGRATED NAVIGATION OF GNSS RTK/ IMU/ TAG SIGNAL

Abstract

GNSS RTK (real-time kinematic) provides very limited navigation performance, sometimes incompetent results, in high speed railway vehicles in terms of position, velocity and attitude, when the vehicles are traveling cross obstructed satellite signal environments, such as platform roofing, adjacent buildings, and tunnels . GNSS and MEMS IMU integrated navigation system is an effective method to improve the positioning reliability. Different from common land vehicles, the railway trains are not able to complete sharps which results in discontinuous attitudes of the system. Lack of rich maneuver, for example smoother accelerating and decelerating than auto cars, also brings weak observabilities in the filtering. The proposed algorithm applies adaptive filter mathematical models. In addition, the scenarios of long tunnel over mountains, along with fast velocity for high speed train, occur frequently. The proposed algorithm adds a delicate strategy for sensor error compensations of MEMS. The developed system embedded the algorithm has been tested on a specific freight routine by multiple rounds, accumulated distance exceed 10 thousand kilometers. The system can achieve 2% errors of positioning accuracy during GNSS outages. The algorithm and the system hardware device are applicable to general navigation purpose for land vehicles with high speed.