

An Integrated DVL/IMU System for Precise Navigation of an Autonomous Underwater Vehicle

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Abstract: This paper describes a hybrid navigation system for an autonomous underwater vehicle (AUV) equipped with a Doppler Velocity log (DVL) and an inertial measurement unit (IMU). The navigation system additionally employed a conventional magnetic heading compass, a depth sensor, and gravitational roll and pitch sensors. A dynamic filter is developed to predict the motion of the AUV, where the hydrodynamic coefficients of the AUV are derived from planar motion measurement (PMM) tests. A data fusion algorithm based on the Kalman filter fuses the various data from the DVL, the IMU, and the other motion sensors and corrects the measurement error to conduct precise navigation. This paper also presents the architecture of the navigation system including the filter algorithm and the extensive data fusion methods. Experiments were performed with a semi-autonomous underwater vehicle (SAUV) and compared with a conventional acoustic navigation system.