

Optimization of Hydrographic Positioning and Attitude Determination

Volker BÖDER, Germany

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SUMMARY

In marine surveying an increasing number of applications requires position data with accuracies of better than 3 cm in real-time with regard to the operation in multi sensor environments. The reduction of the GPS error budget using active reference station networks and site calibration, and the data integration of various sensors fulfill all essential requirements of marine positioning, for example at the German coasts. The main concept is based on real-time precise differential GPS positioning with carrier phase ambiguity resolution. The main errors in GPS positioning can be divided in station and distance dependent effects. Distance dependent errors like satellite orbit and atmospheric delays decrease the accuracy to several ppm (parts-per-million) of the distance between reference and rover station. Geometric and ionospheric parameters are modeled within an active reference station network.

The use of FKP improves the accuracy of the GPS position to better than 1 ppm. An active reference station network along the German coastline is proposed considering existing permanent reference stations of SAPOS. Station dependent errors like phase center variations (PCV) and multipath are determined by absolute field calibration procedures with millimeter accuracy. For the use on mobile platforms the PCV need to be transformed with the platform's attitude data. With both active reference station network and absolute station calibration an accuracy of better than 3 cm is achievable.

On board a marine survey vessel the GPS position needs usually to be transformed to an hydrographic sensor (e.g. echo sounder). In the described multi sensor system a GPS multi antennae system and inertial measurement units determine the ship's attitude with the required accuracy of 0.1° and better. In addition, the positioning accuracy of a GPS supported INS is investigated in order to examine the capabilities of GPS/INS integration and the bridging of GPS data gaps. A concept for such a multi sensor system and the first results on board the survey vessel Level-A (HarbourCity University Hamburg, HCU) will be presented.

CONTACTS

Dr. Volker Böder
Professor
Harbour City University
Hebebrandstraße 1
22297 Hamburg
GERMANY
Tel.: + 49 40 428 27 5393
Fax: + 49 40 428 27 5359
Email: v.boeder@rzcw.haw-hamburg.de