Publications from the

SCHOOL OF SURVEYING AND SPATIAL INFORMATION SYSTEMS

THE UNIVERSITY OF NEW SOUTH WALES
ABN 57 195 873 179

INTEGRATION OF GPS/PSEUDOLITE/INS FOR HIGH PRECISION KINEMATIC POSITIONING AND NAVIGATION

Hung Kyu Lee

UNISURV Report S-76, November, xiv + 200 pages,
A4, paperback, ISBN 0-7334-2149-0

The integrated GPS/INS system has become an indispensable tool for providing precise and continuous position, velocity, and attitude information for many positioning and navigation applications. Integrated GPS/INS systems are still limited by the quality of GPS measurements and the geometric strength of the satellite constellation. To address this problem, the integration of GPS, Pseudolite and INS technologies is investigated. A cost effective GPS/INS integration approach was developed and tested, consisting of a single-frequency L1 GPS receiver and a tactical-grade strapdown INS. Results of field experiments demonstrated that this approach is capable of delivering a position accuracy of a few centimetres under a benign operational environment and provides continuous positioning at sub-decimetre accuracy during GPS signal blockage lasting up to about five seconds.

A novel kinematic positioning and navigation system based on GPS/Pseudolite/INS integration is proposed as an alternative to existing GPS/INS systems. The continuity, integrity, and precision of the GPS/INS system can be significantly improved as the inclusion of pseudolite signals enhances the GPS signal availability and the geometric strength. A new ambiguity resolution procedure and an effective cycle slip detection and identification algorithm were developed for the proposed GPS/Pseudolite/INS system.

Flight trials were conducted to evaluate the overall performance for aircraft approach and landing using the GPS/Pseudolite/INS system. The results show that an enhancement in the accuracy and reliability of the vehicle navigation solution can be achieved with the employment of one or more pseudolite(s).