NOTICE OF THESIS PROPOSAL PRESENTATION

Geodesy and Geomatics Engineering

Doctor of Philosophy

Chaochao Wang

Thursday, May 7, 2009
Head Hall – Room E-11 @ 2:00 pm

Supervisor:	Dr. Peter Dare
Supervisory Committee:	Dr. Richard Langley Dr. Donghyun Kim
Chair:	To Be Announced

Development of Real-Time Tightly Integrated Precise Navigation System

ABSTRACT

With the development of GNSS navigation technology, robust high accuracy navigation performance becomes possible. In recent years, the precise point positioning (PPP) technique has been widely exploited by both research institutes as well as industrial companies. This approach can deliver sub-decimetre level accuracy in real-time by using global satellite orbit and clock corrections broadcast from geostationary satellites. Due to the long convergence (pull-in) time of PPP navigation as well as its necessity of an open sky environment, the GPS PPP technique has limited application in restricted working conditions.

In this research, an innovative approach will be developed to integrate GPS PPP navigation with tactical grade inertial sensors to overcome the above mentioned issues. Firstly, a tightly integrated scheme is developed in an extended Kalman filter to combine GPS code and carrier phase measurements with inertial data. The inertial sensor errors and attitude errors are estimated with the PPP floating ambiguity states in a single Extended Kalman filter. This will allow the system to output the attitude of the platform as well as position and velocity information. The tight integration approach not only allows the system to output navigation solutions when the number of tracked satellites is less than four, but also improves error detection capability and faster code-phase bias state convergence after re-tracking the GPS signal. Therefore, the accuracy and availability of the PPP-based GPS system will improve significantly with tightly coupled inertial sensors.

Special attention has been paid to improving the Kalman filter convergence time with the addition of inertial aiding. With the precise dynamics measured by inertial data, the code-phase bias states are able to converge faster, which can improve the system pull-in time for PPP solutions. During GPS dropout, the inertial sensors are able to bridge the precise navigation results for a small period of time, which allows a much faster pull-in time after GPS reacquisition. The GPS/INS Kalman filter is specifically tuned to achieve optimal precise navigation solutions under shaded environments to provide the best availability and reliability of high performance navigation solutions.

Faculty Members and Graduate Students are invited to attend the 20 minute presentation