NOTICE OF THESIS PROPOSAL PRESENTATION

GEODESY AND GEOMATICS ENGINEERING

Doctor of Philosophy

Ivan Smolyakov

Thursday, June 20, 2019 @ 10:00am

Gillin Hall – Room D108

Supervisor(s):	Richard Langley, Geodesy and Geomatics Engineering
Supervisory Committee:	Marcelo Santos, Geodesy and Geomatics Engineering
	Robert Kingdon, Geodesy and Geomatics Engineering
Chair:	Monica Wachowicz, Geodesy and Geomatics Engineering

ON ENVIRONMENTAL ADAPTATION IN INTEGRATED NAVIGATION SYSTEMS

ABSTRACT

Accurate and reliable GNSS coordinate determination in dense urban areas is complicated due to potentially poor satellite geometry, and unpredictable reception of non-line-of-sight (NLOS) and multipath-contaminated signals. When unaccounted for, these effects cause a solution degradation unacceptable in a variety of mission-critical applications requiring a continuous sub-meter level coordinate accuracy. Three aspects will be investigated in an effort to address the problems of navigation in challenging environments.

First, a platform self-contained effort to detect the NLOS and multipath-contaminated signals with the subsequent filter stochastic model adjustment will be examined. The detection of the refracted GNSS signals is achieved with a context-aided sliding-window-based statistical analysis. It is proposed to develop an adaptive component of the model, allowing for an automatic sliding window size and a detection threshold adjustment.

Second, it is proposed to take advantage of the collaboratively collected contextual data from the connected mass-market platforms operating in a given urban area. The data of interest is used to build a spaciotemporal map of the GNSS signal strength metric derived from the carrier-to-noise-density ratio observable. The empty segments of the map, for which none or insufficient statistics are collected, are proposed to be filled with the GNSS signal strength metric predicted with a machine-learning model. The map is used to adjust the user filter stochastic model with respect to the GNSS signal environment.

Finally, the adaptive unscented Kalman filter INS/GNSS integration will be completed, where the filter adaptation component is based on the model incorporating both the NLOS/multipath-contaminated signal detection and the GNSS signal strength maps. The proposed methods are expected to reach heretofore inaccessible levels of accuracy, integrity, continuity, and availability of the mass-market positioning solution in challenging urban environments.

Faculty Members and Graduate Students are invited to attend this presentation.