Graduate Seminar Conference

Wednesday, November 22, 2006

Department of Geodesy and Geomatics Engineering
University of New Brunswick

The Organizing Committee would like to welcome you to the
2006 Graduate Seminar Conference

Where: Dineen Auditorium – C13

When: Wednesday, November 22, 2006

Please join us for refreshments after the Conference in room C-122, Gillin Hall.

The Organizing Committee
Silvane Paixao
Miguel Vasquez,
with thanks to Sylvia Whitaker

Geodesy and Geomatics Engineering

Graduate Seminar Conference

Dineen Auditorium – C13

Wednesday, November 22, 2006

02:45	*Opening Remarks by Dr. Susan Nichols*
Session 1	***GPS and Surveying***
	Chair: Rajavel Duraiswamy
02:50	*Development of a Semi-Automated System for Monitoring Structural Deformations Using Laser Reflectorless Instrumentation.*
	Chris Gairns
03:10	*Bringing GPS into Harsh Environments for Fully Automated Deformation Monitoring*
	Jason Bond
03:30	*High Latitude GPS Kinematic Positioning Under Various Neutral Atmospheric Mitigation Strategies*
	Reza Ghoddousi-Fard
03:50	*L2C Data Collection and Analysis using a Trimble R7 GPS Receiver*
	Liliána Sükeová
04:10	***Coffee Break***
Session 2	***Remote Sensing, Ocean Mapping and Marine Policy.***
	Chair: Shawn Macfarlane
04:25	*The Wavelet-Based Image Registration Technique for High Resolution Remote Sensing Image*
	Gang Hong

04:45	*Applying Digital Image Analysis Techniques to Reduce Structured Noise in Backscatter Mosaics* **Aluizio Maciel de Oliveira Junior**
05:05	*The Use of Geographic Information Systems in Aquaculture Site Selection in Passamaquoddy Bay, New Brunswick* **Terry Johnston**
05:25	*Close Remarks by Dr. Susan Nichols*
05:30	*Reception*

Development of a Semi-Automated System for Monitoring Structural Deformations Using Laser Reflectorless Instrumentation

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Abstract

Routine structural deformation surveys of large structures are essential in disaster prevention with many other environmental and economical benefits. For example, large oil-storage tanks in Venezuela must be routinely surveyed to monitor the deformation, stability, shape, and overall integrity of each tank.

The Canadian Centre for Geodetic Engineering at the University of New Brunswick has developed the ALERT software package to perform fully automated monitoring of displacements of targeted points using a robotic total station. However, the current version of ALERT is not capable of performing surveys in cases where placing target prisms on the surface of the structure is either impossible or uneconomical.

This research proposal outlines the development of the methodology and software for a system to perform semi-automated structural deformation monitoring using a reflectorless robotic total station in such cases. The proposed monitoring method will greatly reduce labor costs and increase efficiency by reducing the time required to collect, verify, and process data.

Bringing GPS into Harsh Environments for Fully Automated Deformation Monitoring

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Abstract

Engineering projects that require deformation monitoring utilize sensors to measure displacements of target points located in the deformation zone. This is frequently accomplished by using automatic total stations to measure angles and distances to target points demarcated with prisms. The stability of the total stations must be monitored through observations to stable reference points to ensure reliable results. In large scale projects, it is recommended that GPS is used for this purpose to avoid the effects of atmospheric refraction and pointing errors in direction measurements.

In response to this need for continuous, high precision, GPS updates in harsh deformation monitoring environments, software has been developed that employs triple- differenced carrier phase measurements in a delayed-state Kalman filter. Two data sets were analyzed to test the capabilities of the software. In the first test, a GPS antenna was displaced using a translation stage to mimic slow deformation. Next, data collected at a large open pit mine was processed.

It was shown that the delayed-state Kalman filter developed could detect the millimetre level displacements introduced by the translation stage. It was also shown that sub-centimetre precision GPS position updates could be provided in an extremely harsh deformation monitoring environment. Besides the obvious benefit of not having to deal with nuances of cycle slip repair, it was shown that the triple-differenced carrier phase observation can be used to eliminate many of the error sources that would normally plague double-differenced observations. This makes it an extremely useful observable in situations where multipath and/or residual tropospheric delay biases are significant.

High Latitude GPS Kinematic Positioning Under Various Neutral Atmospheric Mitigation Strategies

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Abstract

There have been a number of strategies developed to deal with the neutral atmosphere delay on GPS signals including:

- Using an a priori tropospheric model with surface meteorological measurement or climatic based meteorological look up tables.
- Estimation of the tropospheric delay as an extra unknown in the GPS processing procedure.
- Retrieving refractivity profiles and tropospheric delay estimation (zenith or slant) from a Numerical Weather Prediction (NWP) model.
- Using a Water Vapour Radiometer (WVR) to measure the slant or zenith wet delay and estimate the zenith hydrostatic delay using surface pressure measurements.

During the 2005 Canadian research icebreaker CCGS Amundsen's mission in the Arctic an experiment was carried out to investigate the performance of the Canadian regional NWP model both in observation and position domains. Wet delay measurements using a WVR, surface pressure measurements from a precise barometer, and data from geodetic quality GPS receivers were recorded during most of the sailings. Zenith hydrostatic and non-hydrostatic delays from the NWP model are compared with the WVR and barometer measurements. Long baseline kinematic positioning performance under various neutral atmospheric mitigation strategies such as field measurements, climatic and NWP models are investigated.

L2C Data Collection and Analysis using a Trimble R7 GPS Receiver

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Abstract

A Trimble R7 receiver capable of tracking the L2C signal has been on loan to GGE/UNB. The receiver was connected to the same antenna used by IGS station UNB1/UNBJ and became a part of the L2C signal tracking network.

After the L2C data was collected and processed we examined the signal-to-noise ratios on L1 and L2 frequencies for all satellites. The range of the SRN values on the L1 frequency is similar for all satellites, whilst the range of the SRN on L2 for PRN 17 is higher than those for all other satellites. This indicates an improvement in the SNR of the L2C signal over the P(Y) code.

In the next step the multipath and noise level of the C/A and L2C code pseudorange for PRN 17 were calculated and compared. The standard deviation of the C/A and L2C code noise and multipath is 0.270 m and 0.611 m, respectively. The difference between the standard deviations implies that the Trimble R7 receiver does not combine the two codes which compose the L2C signal as expected. This fact is due to the firmware version in the receiver. Another unexpected behavior of the firmware was found when processing the observations with Precise Point Positioning software.

The Wavelet-Based Image Registration Technique for High Resolution Remote Sensing Image

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Abstract

Image registration is the process of geometrically aligning one image to another image of the same scene taken from different viewpoints or by different sensors. It is an important image processing procedure in remote sensing and has been the focus of studies and research for several decades. Nevertheless, it is still difficult to find an accurate, robust, and automatic image registration method, and most existing image registration methods are designed for a particular application. High resolution remote sensing images have made it more convenient for people to study the Earth; however, they also create challenges for traditional research methods. In terms of image registration, there are a number of problems with using current image registration techniques for high resolution images, namely, (1) very high spatial resolution results in the lowering the altitude of the sensor, which increases the relief displacement and causes localized distortion related to landscape height; (2) precisely locating control points is not as simple as with moderate resolution images; (3) manually selecting the large number of control points required for precise registration is tedious and time consuming; and (4) high data volume adversely affects the processing speed in the image registration. Thus, there is a need for an image registration approach that could resolve these problems. This study proposes a new image registration technique, which is based on the combination of feature-based matching (FBM) and area-based matching (ABM). A wavelet-based feature extraction technique, normalized cross-correlation matching and relaxation-based image matching techniques are employed in this new method. Two pairs of data sets, panchromatic images of IKONOS and a panchromatic image of IKONOS with a multispectral image of QuickBird, are used to evaluate the proposed image registration algorithm. The experiment results show that the proposed algorithm can select enough control points to reduce the local distortions caused by terrain relief.

Applying Digital Image Analysis Techniques to Reduce Structured Noise in Backscatter Mosaics

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Abstract

Backscatter mosaics are useful tools for the seafloor sediment type characterization. They can be produced from sidescan or multibeam data and exhibit superimposed artifacts in the direction of the ship's survey lines, similar to the structured noise as described in Digital Image Analysis literature.

In order to achieve a better classification, Geologists would prefer artifact-free maps. The sonar system and acoustic propagation effects must be filtered out from the original signal, so that the predominant component is the seafloor property signature. Therefore, sensor-specific algorithms need to be developed for each system in order to reduce their particular effects.

In this work, a Digital Image Analysis technique is evaluated to reduce the mosaic noise. The method is tested with mosaics produced with raw and processed multibeam backscatter. In addition, sidescan mosaics are also experimented with. The results demonstrate that the technique should be applicable as an additional tool in the backscatter processing task.

A program called bsfilter was developed using C language to clean the frequency domain signal produced by the Fast Fourier Transform (FFT) of the original mosaic. The user has to choose the survey line direction and a sector filter is created to eliminate the structured noise of the mosaic image.

The Use of Geographic Information Systems in Aquaculture Site Selection in Passamaquoddy Bay, New Brunswick

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Abstract

Salmon aquaculture sites are situated along the New Brunswick coastline of the Bay of Fundy, and occur in high concentration within Passamaquoddy Bay. Due to extreme tides and water circulation in the bay, the influence of water borne by-products, such as nutrients, effluent, and chemical treatments, dispersing from these sites span far beyond their cage boundaries. Aquaculture farmers must take into account the potential interactions between their chosen location and the surrounding sites when selecting a new farm location. Fisheries and Oceans Canada (DFO) has researched and charted water flow and tidal cycles throughout Passamaquoddy Bay, and possess comprehensive tidal dispersion data in the areas surrounding existing cage sites.

Under the current aquaculture site application and approval process, fish farmers hire consultants to perform site suitability analyses before approaching the New Brunswick Provincial government with their selections. Despite DFO's extensive spatial data of the Bay of Fundy tides, it merely acts as an advisor to the provincial government in the site selection process. DFO has begun to incorporate GIS technology into its tidal drift analyses, which will allow the organization to effectively use their data holdings to forecast cage-site interactions and hasten the site selection process.

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