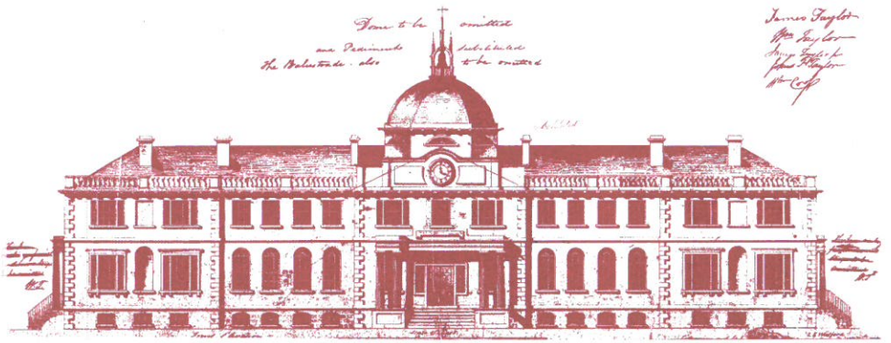
EXTRACTING SONAR RELATIVE ALONG-TRACK AND ACROSS-TRACK RADIOMETRIC BEAM PATTERN FOR MULTI-SECTOR MULTI-SWATH MULTIBEAM SONAR

ABSTRACT

The use of multibeam acoustic backscatter data for bottom characterization is currently being attempted by many researchers to aid geological, biological, and engineering projects. Ideally the absolute bottom backscatter strength would be measured, but in reality the reported data are overprinted by system related effects. In real time, manufacturer-applied gain only reduces geometric and radiometric effects. Subsequently existing post-processing algorithms undertake improved but still imperfect corrections to better account for residual artifacts due to geometric and radiometric effects. The geometric effects include changing range, grazing angle and insonified area across the swath, whereas the radiometric effects include the variation in the transmitted energy and the receiver sensitivity. Recent developments in motion stabilization that involves multiple sectors, which are used to achieve higher and more equal sounding density, have added significantly more radiometric complications to the backscatter data. Before the backscatter data can be used for classification, either in the form of a mosaic or in the form of backscatter strength angular response curves, these remaining residual artifacts in the data have to be properly minimized.

The remaining residual artifacts reflect the fact that existing empirical beam pattern corrections imperfectly account for geometry and radiometry, and do not adequately distinguish between grazing and sonar relative angle. This research attempts to develop a new method of reducing the backscatter data by explicitly differentiating between seafloor angular response and radiometric artifacts. The new method further differentiates between along-track and across-track radiometric beam patterns. The developed method does not require any prior knowledge of seafloor characteristics. It is capable of propagating uncertainty from the backscatter data to obtain uncertainty of extracted radiometric beam pattern. This enables the user to access the reliability of extracted radiometric beam patterns.

While limitations will always remain due to other factors, the developed method derives the angular response curves with minimum geometric and radiometric effects. These angular response curves can then be used to extract seafloor properties or to estimate changes in the sediment types over time with increased confidence.



Home of the School of Graduate Studies, Sir Howard Douglas Hall was designed by J.E. Woolford in 1825 and is the oldest university building in Canada still in use.

UNIVERSITY OF NEW BRUNSWICK

SCHOOL OF GRADUATE STUDIES

ORAL EXAMINATION

Anand Hiroji

IN PARTIAL FULFILMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

Ph.D. Candidate

Anand Devappa Hiroji

Graduate Academic Unit

Geodesy & Geomatics Engineering

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May 4, 2016

2:00 p.m.

Head Hall
Room E-11

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Examining Board:

Dr. John Hughes Clarke (Geodesy & Geomatics Eng.)	Supervisor
Dr. Yun Zhang (Geodesy & Geomatics Eng.)	
Dr. Jonathan Beaudoin (HRA, Geodesy & Geomatics Eng.)	
Dr. Karl Butler (Earth Sciences)	Chairperson

External Examiner:
Dr. Bob Courtney
Research Scientist
Natural Resources Canada

The Oral Examination will be chaired by:
Dr. John Kershaw, Associate Dean of Graduate Studies

BIOGRAPHY

Universities attended (with dates & degrees obtained)

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2009-2011 MEng., Geodesy and Geomatics Engineering, University of New Brunswick

2001-2005 BE, Civil Engineering, PVPIT Budhgaon, Shivaji University, India

Research position:

2006-2007 Research Assistant, Indian Institute of Technology Bombay, Mumbai, India

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