



COLLEGE OF ENGINEERING
AND COMPUTER SCIENCE
FLORIDA ATLANTIC UNIVERSITY

Announces the Ph.D. Dissertation Defense of

Eric Nieves

for the degree of Doctor of Philosophy (Ph.D.)

“Applying Blind Source Separation to Magnetic Anomaly Detection”

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Virtual Dissertation

DEPARTMENT:

Department of Ocean and Mechanical Engineering

ADVISOR:

Pierre-Philippe Beaujean, Ph.D.

PH.D. SUPERVISORY COMMITTEE:

Pierre-Philippe Beaujean, Ph.D., Chair

Manhar Dhanak, Ph.D.

Pak-Cheung An, Ph.D.

Siddhartha Verma, Ph.D.

ABSTRACT OF DISSERTATION

Applying Blind Source Separation to Magnetic Anomaly Detection

The research shows a novel approach for the Magnetic Anomaly Differentiation and Localization Algorithm, which simultaneously localizes multiple magnetic anomalies with weak total field signatures (≤ 10 nT). It focuses on the case where there are two homogeneous targets with known magnetic moments. This was done by analyzing the magnetic signals and adapting Independent Component Analysis (ICA) and Simulated Annealing (SA) to solve the problem statement. The results show the groundwork for using a combination of fastICA and SA to give localization errors of 3 meters or less per target in simulation and achieved a 58% success rate. Experimental results experienced additional errors because of magnetic background, unknown magnetic moments, and navigation error. While one target was localized within 3 meters, only the latest experimental run showed the second target approaching the localization specification. This highlighted the need for higher signal-to-noise ratio and equipment with better navigational accuracy. The data analysis was used to provide recommendations on the needed equipment to minimize observed errors and improve algorithm success.

BIOGRAPHICAL SKETCH

Born in Pensacola, Florida

B.S., University of Florida, Gainesville, Florida, 2014

M.S., Florida Atlantic University, Boca Raton, Florida, 2017

Ph.D., Florida Atlantic University, Boca Raton, Florida, 2020

CONCERNING PERIOD OF PREPARATION

& QUALIFYING EXAMINATION

Time in Preparation: 2017 – 2020 (2015 – 2020 if you include Masters time)

Qualifying Examination Passed: Spring 2018

Published Papers:

- E. Nieves, P. Beaujean, M. Dhanak, G. Valdes, B. Nelson and W. Avera, "Isolating the magnetic signature of internal waves," *OCEANS 2017 - Anchorage*, Anchorage, AK, 2017, pp. 1-6.
- Nieves, E. (2017). *Characterizing the magnetic signature of internal waves* (Order No. 10616269). Available from Dissertations &

Theses @ Florida Atlantic University - FCLA; ProQuest Dissertations & Theses A&I; ProQuest Dissertations & Theses Global. (1970382202). Retrieved from

<https://login.ezproxy.fau.edu/login?url=https://www.proquest.com/docview/1970382202?accountid=10902>

- E. Nieves *et al.*, "Optimizing Correlations of Magnetic and Hydrodynamics Signatures," *OCEANS 2018 MTS/IEEE Charleston*, Charleston, SC, 2018, pp. 1-8, doi: 10.1109/OCEANS.2018.8604660.
- E. Nieves, P. Beaujean and M. Dhanak, "Applying Blind Source Separation to Magnetic Anomaly Detection Algorithms," *OCEANS 2019 MTS/IEEE SEATTLE*, Seattle, WA, USA, 2019, pp. 1-8, doi: 10.23919/OCEANS40490.2019.8962565.