

MASTER OF SCIENCE IN ENGINEERING ACOUSTICS

SHALLOW WATER ACOUSTIC VARIABILITY AND INFLUENCES ON AUTOCORRELATION MATCHING LOCALIZATION ALGORITHMS

Arthur F. Bettega Correa-Lieutenant, Brazilian Navy
B.S., Escola Naval, 1986

Master of Science in Engineering Acoustics-December 1998

Advisor: Kevin B. Smith, Department of Physics

Second Reader: Mitchell Shipley, Department of Physics

In this work, several algorithms based on higher-order moment (autocorrelation) matching of single hydrophone element data have been developed and tested on real transient data sets. Of particular interest is the success and robustness of the Frequency-Domain Autocorrelation Matching (FACM) algorithms in the presence of environmental mismatch, signal mismatch, and noise, for different signals in an unknown environment. Recently acquired data was analyzed for signal variability in terms of spatial coherence of phones, beams, and modal structure. The ability to localize using these higher-order moment matching algorithms was compared to the spatial structure of the signal, the placement of the receiving elements, and the signal variability.

This work suggests that the FACM algorithms are strongly dependent on the source-receiver relative positions, and on the uniqueness of the signal vertical structure. It is also shown that their performance increases with the number of multipath arrivals and, therefore, with the range. More importantly, the localization results obtained with raw linear frequency modulated (LFM) signals seemed to be as useful as the ones obtained from matched-filtered data.

DoD KEY TECHNOLOGY AREA: Modeling and Simulation

KEYWORDS: Transient Localization, Autocorrelation Matching, Plane-Wave Beamforming, Modal Decomposition