

XIV. DETECTION AND ESTIMATION THEORY

Academic Research Staff

Prof. A. B. Baggeroer
Prof. H. L. Van Trees

Graduate Students

S. J. Leverette
L. S. Metzger

J. W. Moffett
J. M. F. Moura
S. A. Parl

L. C. Pusey
K. B. Theriault

RESEARCH OBJECTIVES AND SUMMARY OF RESEARCH

1. Tracking of Narrow-band Space/Time Random Processes with Adaptive Arrays

Joint Services Electronics Program (Contract DAAB07-71-C-0300)

J. M. F. Moura, L. S. Metzger, A. B. Baggeroer

The location of narrow-band sources has traditionally been tracked by using "bearings only" information supplemented by Doppler measurements. The actual spatial/temporal structure of the signal is closely coupled with the relative motion dynamics of the source and receiver. An integrated approach to the tracking of the source location using parameter and continuous estimation theory has been developed.¹ We are studying problems of global acquisition and observability, as well as potential methods for calculating the posterior probability density of the array signals.

References

1. J. M. F. Moura, H. L. Van Trees, and A. B. Baggeroer, "Space/Time Tracking by a Passive Observer," Proceedings of the Nonlinear Estimation Theory Conference, San Diego, California, 1973.

2. Detection and Estimation Theory Methods

Joint Services Electronics Program (Contract DAAB07-71-C-0300)

S. A. Parl, L. C. Pusey, A. B. Baggeroer

Investigations of estimating processes with distributed dynamics and boundary conditions have been made, and the results are being applied to internal oceanographic wave processes. We are studying spectral analysis and frequency wave-number function estimation. Generalizations of the adaptive "maximum-likelihood" and "maximum-entropy" procedures are being examined by using the concepts of parameter and optimum linear filtering theory and the resulting error performance.

(XIV. DETECTION AND ESTIMATION THEORY)

3. Seismic Data Processing for the IDOE East Atlantic Continental Margin Program

National Science Foundation (Grant GX-36331)

K. B. Theriault, S. J. Leverette, A. B. Baggeroer

This effort is a joint program with Woods Hole Oceanographic Institution for the seismic data processing associated with the NSF International Decade of Ocean Exploration – East Atlantic Continental Margin Program. Previous investigations have

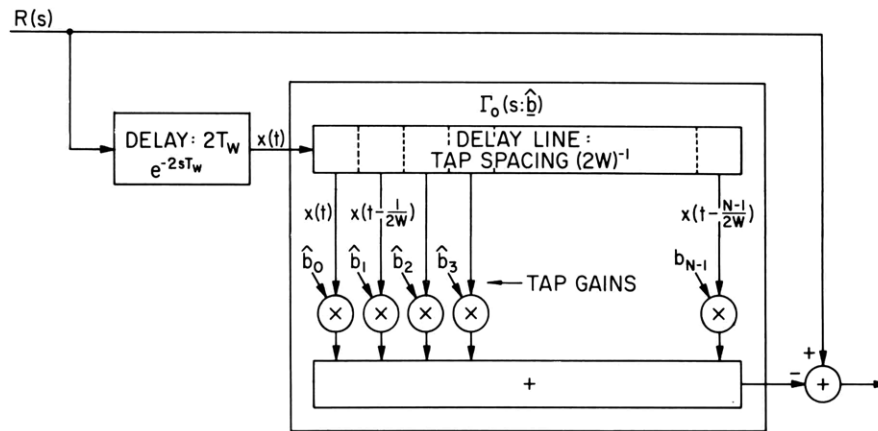


Fig. XIV-1. Inverse filter using tap delay-line structure.

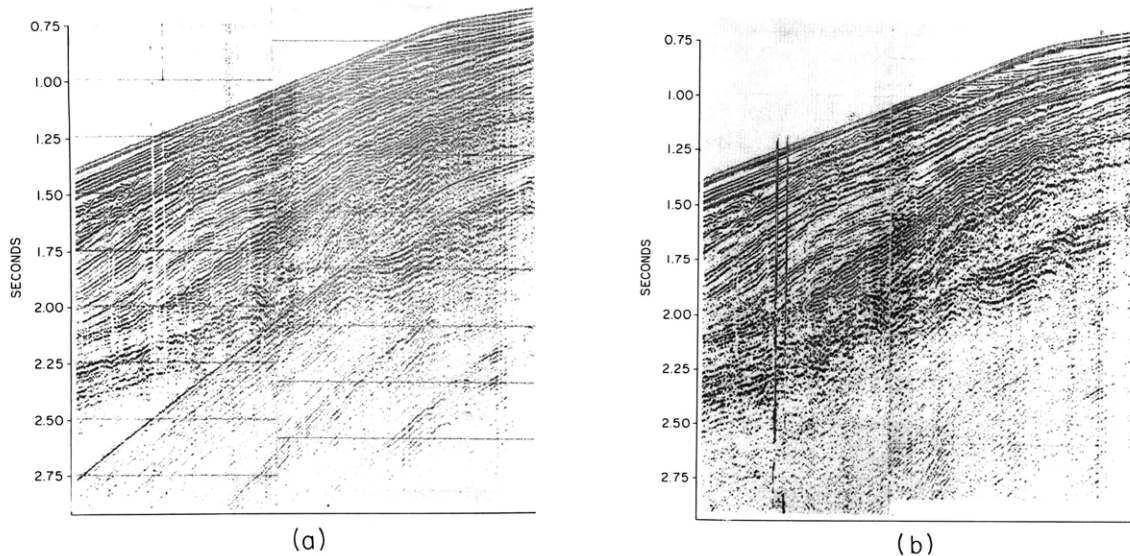


Fig. XIV-2. Comparison of seismic records for a line west of the Orange River.
 (a) Before processing.
 (b) After processing.

(XIV. DETECTION AND ESTIMATION THEORY)

considered the removal of water column multiples or echoes, by using tapped delay-line filters. These investigations were reported in "Tapped Delay Line Models for the Dereverberation of Deep Water Multiples," Progress Report No. 1 for this Grant, submitted in June 1973.

We are now using signals recorded by a source monitor to determine the effects of applying scattering function theory for designing dereverberation filters (Figs. XIV-1 and XIV-2). Adaptive stacking of successive reflections is also being investigated. Future work using a six-channel array for seismic profiling is being planned for a 1975 IDOE Brazilian cruise.

