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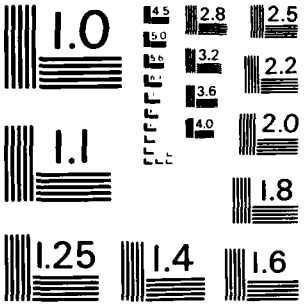

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The Ohio State University

ADVANCED ADAPTIVE ANTENNA TECHNIQUES

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Quarterly Report 714505-4

Contract N00019-82-C-0190

June 1983

Naval Air Systems Command
Washington, D.C. 20361

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This report describes progress under Naval Air Systems Command Contract N00019-82-C-0190 during the second quarterly period. Research on the behavior of adaptive arrays with frequency-hopped signals is summarized.

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TABLE OF CONTENTS

I. INTRODUCTION

This report describes progress under Naval Air Systems Command Contract N00019-82-C-0190 for the second quarterly period. This contract involves research in two areas: (1) the performance of adaptive arrays with frequency-hopped signals, and (2) the performance of adaptive arrays based on the Frost algorithm [1].

During the second quarter of this contract, most of our work has again been concentrated on the first problem, adaptive arrays with frequency-hopped signals. Our progress is described below.

II. PROGRESS

During the second quarter we have continued our studies on the performance of adaptive arrays that receive frequency-hopped desired signals. We have finished developing and debugging computer programs that calculate several things of interest: the time response of the array weights, the array output SINR versus time, the bit error probability when the array is used in a DPSK (differential phase shift keyed) communication system, the array pattern versus time, and other quantities. These programs all allow one to input arbitrary array and signal parameters. In particular, the frequency hopping characteristics can be varied as desired.

Using these programs, we have run numerous curves of weight response, SINR, bit error probability, array patterns and other quantities of interest. We are currently studying these results to

characterize them and are preparing a report that describes the effects of frequency hopping on the array performance.

III. REPORTS PUBLISHED

During the second quarter we have also published a technical report on the effects of interference signal phase modulation on adaptive array performance [2]. This report does two things. First, it presents a mathematical technique that allows one to solve for the time behavior of the array weights when there is phase modulation on the interference. Second, it shows how this method may be used to determine the performance of a 2-element array that receives an interference signal with sinusoidal phase modulation. The effects of interference phase modulation on the array behavior are shown to be similar to those of interference envelope modulation [3]: the array modulates the desired signal, and the array output SINR varies with time and causes the desired signal bit error probability to increase. The report discusses these effects and relates them to the interference parameters (modulation frequency, phase deviation, power and angle of arrival).

IV. PLANS FOR NEXT QUARTER

During the next quarter we plan to finish our studies on frequency hopping with adaptive arrays. A report will be published on this work. Also, we plan to begin studies to determine the performance of the Frost beamformer as a function of the number and type of constraints and other parameters.

V. FINANCIAL

As of December 31, 1982, a total of $43,161.48 has been expended and an additional $662.90 has been committed but not yet paid. Thus, a total of $43,824.38 has been spent or committed. This amount is $3,824.38 over the initial funding of $40,000. (This contract is incrementally funded in two $40,000 amounts. The second $40,000 has not yet been received.)

VI. REFERENCES

[1] O.L. Frost III, "An Algorithm for Linearly Constrained Adaptive Array Processing", Proc. IEEE, Vol. 60, No. 8 (August 1972), p. 926.

[2] A.S. Al-Ruwais and R.T. Compton, Jr., "Adaptive Array Behavior with Periodic Phase Modulated Interference", Technical Report 714505-3, June 1983, The Ohio State University ElectroScience Laboratory, Department of Electrical Engineering; prepared under Contract N00019-82-C-0190 for Naval Air Systems Command, Washington, D.C.

[3] A.S. Al-Ruwais and R.T. Compton, Jr., "Adaptive Array Behavior with Periodic Envelope Modulated Interference", Technical Report 714505-1, December 1982, The Ohio State University ElectroScience Laboratory, Department of Electrical Engineering; prepared under Contract N00019-82-C-0190 for Naval Air Systems Command, Washington, D.C.


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