ANALYTIC SIGNAL PROCESSING

BY

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Submitted in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy in Electrical Engineering
in the Graduate School of
Illinois Institute of Technology

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Chicago, Illinois
December, 1983

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1983

ACKNOWLEDGEMENT

This thesis is a result of a joint research venture between Illinois Institute of Technology and Bell Laboratories in Naperville, Illinois. It would not have been possible without the generous financial support and the use of the resources of the Advanced Switching Services Laboratory. In particular, most of this work is a direct result of many stimulating conversations with Walt Hartwell concerning analytic signals. His many insights into analytic signals has given most of the shape to this work. I am personally indebted to Dimitrios P. Prezas, a friend and colleague, for his continuous involvement in this work. The many hours he has devoted to this project has made the past two years an invaluable experience.

To my advisor, Joseph L. LoCicero, goes a special thanks for transforming an idea about a joint research venture into a reality. His guidance and assistance is deeply appreciated. Also, I wish to thank the Department of Electrical Engineering for its financial support through my graduate studies, and in particular, Kenneth W. Haag for his personal assistance in these matters.

Finally, I wish to thank my wife for her patience, tolerance, and understanding.

J. P.

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ABSTRACT

High resolution spectral estimation algorithms traditionally are constrained to process a finite segment of data, assuming the data to be zero outside the analysis interval. These assumptions ultimately limit the resolution which can be achieved by these estimators. Analytic signals provide an alternate signal representation whereby long-term phase information can be incorporated into the analysis data. Analytic signal-based spectral estimators are shown to achieve higher resolution than their real signal counterparts, due to the phase-invariance property of an analytic signal. This is demonstrated in both the analog and discrete domains. The linear predictive estimates of stationary signals in additive Gaussian noise, using a complex linear predictor, are shown to be more consistent than those obtained using a comparable real linear predictor. Experimental results are included for two analysis algoithms: the Burg algorithm and the autocorrelation method.

The analytic signal representation has been applied to data compression techniques for speech encoding. Multi-pulse linear predictive coding (MPLPC) is developed as a sub-optimal two-stage system identification algorithm. Several complex parameter coding algorithms are presented as sub-optimal solutions to a two-dimensional quantization problem. Two techniques to transform complex predictor coefficients to equivalent real predictor coefficients are

included as alternate coding algorithms. An analytic multi-pulse linear predictive coding system (AMPLPC) has been designed which provides improved speech quality over its real signal counterpart at rates ranging from 9.6 kbits/s to 14.4 kbits/s.