STUDIES ON OPTIMUM DEMODULATION AND SPEECH PROCESSING

SURENDRA PRASAD

Thesis submitted to the Indian Institute of Technology, Delhi, for the award of the degree of Doctor of Philosophy

Department of Electrical Engineering
Indian Institute of Technology, Delhi

December 1974

ACKNOWLEDGEMENTS

The thesis describes the results of investigations carried out by the author over a period from January 1972 to December 1974 at the Indian Institute of Technology, Delhi. It is with great pleasure and gratitude that the author acknowledges the help, encouragement and guidance of Professor A.K. Mahalanabis throughout the course of this work. It was entirely through his steadfast efforts that I was able to take up this work.

The author is very grateful to Professor P.V. Indiresan, Head - School of Radar Studies, for his constant encouragement and support during the course of this work.

Thanks are also due to some friends at the Indian Institute of Technology, for their good wishes; to Dr. K.K. Biswas for some useful discussions; and to Mr. D.R. Joshi for his patient typing of the manuscript.

(S. Prasad)

CONTENTS

CHAPTER		PAGE No.
1.	INTRODUCTION AND PRELIMINARIES	1 - 21
	1.1 Introduction	
	1.2 System description	
	1.3 A brief survey of the earlier work	
	1.4 The problem of data rate reduction of speech signals	
	1.5 Scope of the present study	
	1.6 Organization of the thesis	
2.	FINITE LAG RECEIVERS FOR ANALOG COMMUNICATION	22 - 50
	2.1 Introduction	
	2.2 Formulation of the problem	
	2.3 Fixed lag smoothing	
	2.4 Applications to analog communication:amplitude modulation	
	2.5 The case of phase modulation	
	2.6 An optimum phase demodulator	
3.	FINITE LAG RECEIVERS FOR FADING CHANNELS	51 - 73
	3.1 Introduction	
	3.2 State variable model for communication in fading channels	
	3.3 Receivers for AM signals	
	3.4 Receivers for phase modulated signals	

OPTIMUM DEMODULATION IN PULSE COMMUNICATION SYSTEM EMPLOYING SECONDARY FREQUENCY MODULATION 74 - 91

4.1 Introduction

4.2 Formulation of the problem

4.3 Optimum zero lag receivers and their performance

4.4 Optimum finite lag receivers

4.5 Examples and comparison of some primary modulation schemes

5. A CLASS OF DIRECT DETECTION RECEIVERS FOR OPTICAL COMMUNICATION 92 - 107

5.1 Introduction

5.2 The optical communication model

5.3 Zero lag receivers

5.4 Finite lag receivers

5.5 Performance

6. SENSITIVITY ANALYSIS OF FINITE LAG RECEIVERS 108 - 127

6.1 Introduction

6.2 Sensitivity analysis of fixed lag smoothing

6.3 Discrete sensitivity algorithms

6.4 Steady state analysis of sensitivity

6.5 Applications

7. SOME RESULTS ON THE APPLICATION OF ADAPTIVE KALMAN FILTERING TECHNIQUES IN PREDICTIVE CODING OF SPEECH SIGNALS 128 - 146

7.1 Introduction

7.2 A state variable model for speech signals

7.3 Adaptive predictive coding using the above model

7.4 Simulation results

8. SUMMARY AND SUGGESTIONS FOR FURTHER WORK 147 - 155

8.1 A brief summary

8.2 Some suggestions for further work

APPENDIX 156 - 160

REFERENCES 161 - 168