SOFTWARE DEVELOPMENT FOR ESTIMATING THE DIRECTION OF ARRIVAL OF MULTIPATH SIGNAL USING LABWINDOWS/CVI

Thesis is presented in partial fulfilment for the award of the

Bachelor of Engineering (Hons) *in Electrical Engineering*

Faiz bin Haji Faisal
Department of Electrical Engineering
Institut Teknologi MARA
40450 Shah Alam
Selangor D.E.
Malaysia
MAY 1997

ACKNOWLEDGEMENTS

In the name of Allah, Most Gracious, Most Merciful. Praise be to Allah, the One and Only, for allowing this 'Opportunity' to the author.

It is the author's wish to express his gratitude toward the project supervisor, Dr. Ahmad Haire Abu Bakar, for allowing the chance to work under his guidance. It has been a most fulfilling experience and the author would like to thank him for his guidance, views and opinion in completing this thesis.

The author would also like to express his thankfulness to his family for understanding the sacrifices required in the process of completing this thesis.

Special thanks should also be mentioned here to the staff of CADEM, lecturers involved and fellow students for assisting, supporting and providing access required during the course of completing this thesis.

ABSTRACT

Propagating signals contains a lot of information about the sources that produces them. Not only does each signals' waveform express the nature of the source, its temporal and spatial characteristics combined with the law of physics allows us to determine the source's location. However, it is array signal processing that will do the process of obtaining the insight of the wave structure. The practical problem of interest in array signal processing are extracting the desired parameter such as direction of arrival (DOA). Beamforming algorithm is integrated into the latest version of the C-language, CVI, where it will be used as a tool in achieving the DOA of multipath radio signals.

TABLE OF CONTENTS

CHAPTER 1

CHAPTER 2

CHAPTER 1

1.0.0 INTRODUCTION TO DOA

The direction of arrival DOA problem is of interdisciplinary interest and a number of algorithms have been developed for its solution. These include beamforming, maximum likelihood, least square error modeling and signal subspace methods (MUSIC, CAPON) to name a few [4]. The fundamental DOA problem is concerned with empirical snapshot data to estimate the individual sources DOA parameter vectors that characterize the multiple incident point sources.

Sensor array signal processing is the process used to determine the angular location of certain sources that are radiated or reflected. This is often called the angular bearing or direction of arrival (DOA). A closer look in detail regarding this topic will be discussed in the next topic.

Array processing deals with method for processing the output data of an array of sensor at different point in space in a wavefield. In this paper the signal that will be processed are radiowave. A radiowave is an electromagnetic wave that can be captured by an array of sensors. In passive situation, when a source transmits its radio signals through typical environments, the components of signals reach the array via a direct or indirect path or both. This multiplicity of path is known as *multipath* phenomenon and it can occur whether in outdoor or indoor environment. This will be discussed further under the topic 'Radio wave propagation' and signal enhancement and characterization'.