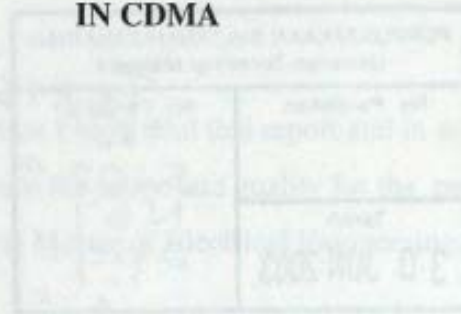


**THE USE OF CONVOLUTIONAL CODING TO REDUCE BIT ERROR RATE  
IN CDMA**



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**A PROJECT REPORT SUBMITTED IS TO FULFILMENT THE  
REQUIREMENT FOR THE MASTER OF ELECTRICAL ENGINEERING**

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Firstly, I would like to acknowledge the guidance and help given by my supervisor, Prof. Dr. Tjandjoe Abdul Halim, throughout the development of this project. Also I would like to pay special thanks to my friends and all those people who had been helping me along this project successful.

***To Tuan Haji Mohamad Noor , Puan Hajjah Hasma & my family.***

***You are part of my life and this Thesis***

***Is dedicated especially for you.***

## ACKNOWLEDGEMENT

I would like to take this opportunity to thank all parties involved in the making of this thesis.

Firstly, I would like to acknowledge the guidance and help given by my supervisor, Prof. Dr. Tharek bin Abdul Rahman, throughout the development of this project. Also I would like to pay special thanks to my friends and all those people who had been helping me make this project successful.

## ABSTRACT

The purpose of this project is to see the effectiveness of convolution coding in order to reduce the bit error rate. To create the simulation block for this project, MATLAB software has been used with focus on SIMULINK.

With the use of Additive White Gaussian Noise (AWGN) channel, the data had been transmit through the convolution coding, then change the channel to Multipath Rayleigh Fading. This comparison proves that convolution coding can reduce bit error rate and the use of AWGN channel is better than Multipath Rayleigh Fading channel.



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<b>DEKLARASI</b> Projek ini dijalankan bertujuan untuk melihat keberkesanan “convolution coding” di dalam mengurangkan kadar kesilapan bit semasa maklumat dihantar dengan menggunakan kaedah “Code Division Multiple Access (CDMA)”. Perisian MATLAB digunakan dan ianya lebih tertumpu kepada penggunaan SIMULINK.	1
<b>TAMBAH</b> Peringkat pertama, maklumat dihantar melalui “convolution coding” dan menggunakan saluran “Additive White Gaussian Noise” dan peringkat kedua, saluran tadi ditukar dengan saluran “Multipath Rayleigh Fading”. Dari apa yang telah dijalankan, dapatlah dipastikan keberkesanan penggunaan “convolution coding” dan juga pemilihan saluran yang bersesuaian untuk penghantaran maklumat.	1
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## CHAPTER I

## INTRODUCTION

## 1.1 INTRODUCTION OF THE PROJECT

Code division multiple access (CDMA) is one of multiple access method that allow the user to spread the information signal across the assigned frequency band. The signal from the various users is separated at the receiver by cross correlation of the received signal with each of the possible user signature sequences. By designing these code sequences to have relatively small cross-correlations, the crosstalk inherent in the demodulation of the signals received from multiple transmitters is minimized.

## 1.3 OBJECTIVE

The multiple access methods for the radio channels are divided into two main categories: FDMA and TDMA. FDMA is used in mobile communication networks, while TDMA is used in mobile communication networks and wireless access networks. Code division multiple access (CDMA) is regarded a promising technique for the future mobile radio networks. It is widely used and has spectrum efficiency results in CDMA systems. This project will show the bit error rate by using the conventional coding and different channel.

## INTRODUCTION

CDMA has become the primary access method because:

- CDMA is less prone to deep multipath fading caused by transmission with delay at the receiver that followed different propagation paths.
- CDMA can operate with much lower transmit powers leading to smaller handsets.

### 1.1 INTRODUCTION OF THE PROJECT

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## 1.2 OBJECTIVE

The multiple access methods are the basis for current and future wireline and wireless communication networks, such as satellite network, cellular and mobile communication networks and underwater acoustic networks. Code division multiple access communication is regarded a promising technique for future mobile radio networks. It is widely accepted that spectrum communications results in efficient spectrum use. This project will show the bit error rate by using the convolutional coding and different channel.

CDMA has become the famous access method because:

- CDMA is less prone to deep multipath fading caused by transmission arriving at the receiver that followed different propagation paths.
- CDMA can operate with much lower transmit powers leading to smaller handsets and smaller batteries and longer life.
- CDMA can reduce interference between cells in cellular networks and improve handover.
- CDMA system has the ability to co-exist with conventional narrow-band transmission.
- CDMA can simplify cell planning by removing the need to specify rigid frequency allocation to individual cells.
- CDMA is able to increase capacity more easily.
- CDMA can provide higher spectrum efficiency.



### 1.3 SCOPE OF WORK

In order to get this thesis successfully done; the scope of the work has been done in such a way that it involves the following stage:

- The theoretical explanation about code division multiple access.
- The steps taken in build the bit error rate simulation block.
- Compare the bit error rate by using the convolution coding.
- See the different between the Additive White Gaussian Noise and Multipath Rayleigh Fading channel.

### 1.4 THESIS LAYOUT

This thesis consists of six chapters. In the first chapter, it will give an introduction that includes of the objective and the scope of the project. In chapter two, the discussion is about MATLAB, the software that has been used. It gives more concentration on SIMULINK. Chapter three consists of the theory of the code division multiple access (CDMA). Chapter four will cover the block design for the whole project. It will explain on how to make use the toolbox that contains the ready-to-use functions and block, which can modify to implement custom schemes, methods and algorithms. Chapter five is the result of the project. Lastly chapter six will give the conclusion of the thesis, which will conclude this overall study. The recommendation will also be included in this chapter.

Typical user activities:

- Math and computation.
- Algorithm development.
- Modeling, simulation and prototyping.
- Data analysis, visualization and **CHAPTER II**
- Scientific and engineering graphics.
- Application development, including graphical user interface building.

## COMPUTER SIMULATION USING MATLAB

### 2.1 INTRODUCTION

MATLAB was originally written to provide easy access to matrix software developed by the LINPACK and EISPACK project, [1] which together represent the state of the art in software for matrix computation. Today MATLAB is used in a variety of application including signal and image processing, control system design, financial engineering and medical research. MATLAB also features a family of application-specific solutions called toolboxes. Toolboxes, which are available, include signal processing, control system design, dynamic system simulation, system identification, neural networks, fuzzy logic and others.

MATLAB is the high-performance language for technical computing that combines numeric computation, advanced graphics and visualization and a high-level programming language. [1]

Typical uses include:

- Math and computation.
- Algorithm development.
- Modeling, simulation and prototyping.
- Data analysis, exploration and visualization.
- Scientific and engineering graphics.
- Application development, including graphical user interface building.

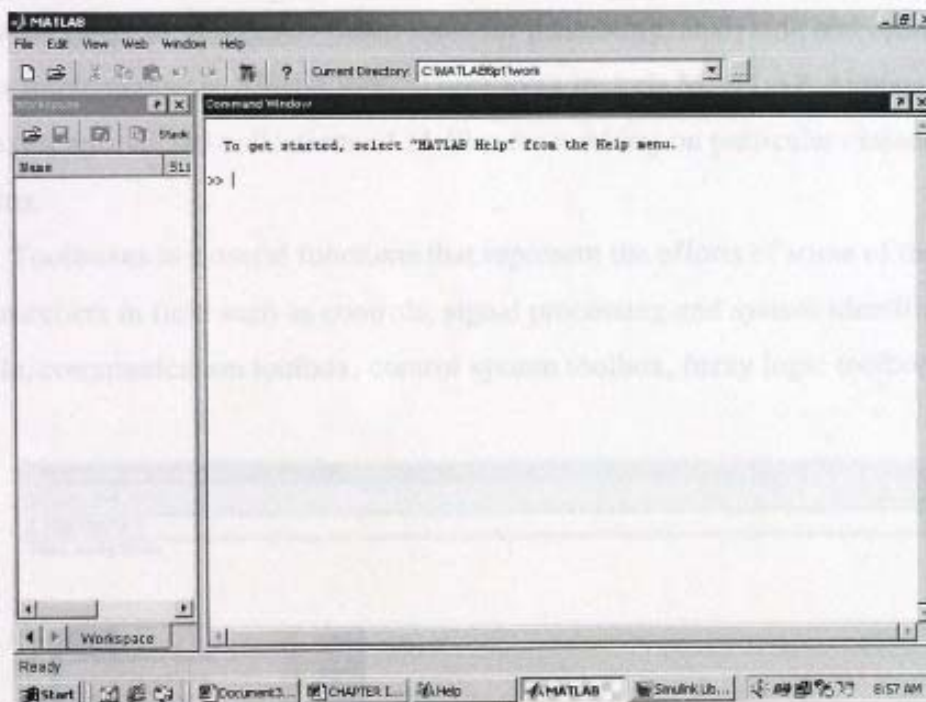


Figure 2.1 MATLAB main screen



## 2.2 SIMULINK APPLICATION TOOLBOX

SIMULINK is a software package for modeling, simulating and analyzing dynamical systems. It supports linear and nonlinear systems, modeled in continuous time, sample time or a hybrid of the two. For modeling, SIMULINK provides a graphical user interface (GUI) to build models as block diagrams, using click-and-drag mouse operation.

SIMULINK is built atop MATLAB. As a result, SIMULINK can direct access to the wide range of MATLAB-based tools for generating, analyzing and optimizing systems implemented in SIMULINK. These tools include MATLAB Application Toolboxes, specialized collections of M-files for working on particular classes of problems.

Toolboxes is a useful functions that represent the efforts of some of the world's top researchers in field such as controls, signal processing and system identification. For example, communication toolbox, control system toolbox, fuzzy logic toolbox and etc.

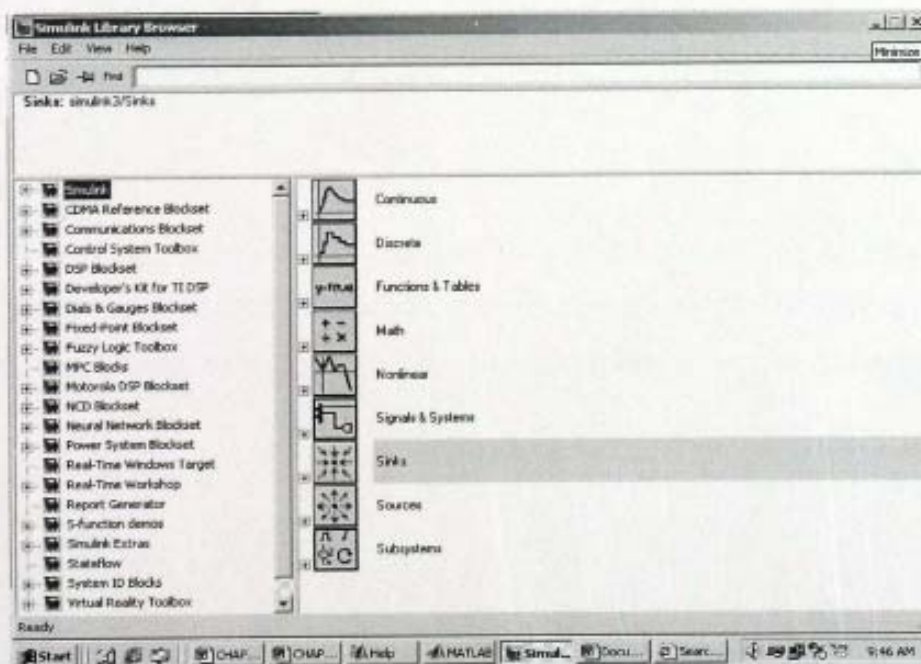


Figure 2.2 Simulink

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