

SIMULATION AND PERFORMANCE OF SPACE TIME FREQUENCY CODING BY USING TURBO CODE

**Thesis submitted to the Faculty of Electrical Engineering,
Universiti Teknologi MARA in fulfillment of the requirement for the
Bachelor Degree of Electrical Engineering (Honors)**



**ISMAIL BIN HJ IBRAHIM
FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM
SELANGOR DARUL EHSAN**

NOVEMBER 2008

ACKNOWLEDGEMENT

In the name of Allah SWT, The Most Gracious who has given me the strength and an ability to complete this project. All perfect praises belong to Allah S.W.T, Lord of the universe and His blessings upon the Prophet Muhammad saw, and members of his family and companions.

I would like to express my deepest gratitude to my Project Supervisor, Puan Suzi Seroja Binti Sarnin as her guidance, ideas and patience in advising and assisting the project. May God bless you.

To my lecturer, Dr Hilmi Bin Sanusi who has given me a lot of supports and encouragement's to fulfill my project and being wise advisors. Thank you very much.

My deepest appreciation goes to my parents and Arhasliza Binti Arshad for their love, understanding and encouragement and being the source of my inspiration.

TABLE CONTENTS

CHAPTER	PAGE
DECLARATION	
ACKNOWLEDGMENT	ii
TABLE OF CONTENTS	iii
LIST OF FIGURES	v
LIST OF TABLES	vii
LIST OF ABBREVIATIONS	viii
ABSTRACT	ix
CHAPTER	
1. INTRODUCTION	1
1.1 Background	1
1.2 Objective	3
1.3 Problem Statement	4
1.4 Scope of Project	5
1.4.1 Turbo Code as encoder/decoder	6
1.4.2 Modulation Techniques	8
1.4.3 Space Time Frequency Coding	9
1.4.4 Additive White Gaussian Noise	9
1.4.5 Matlab Simulation	10

ABSTRACT

This project highlights the simulation using Space Time Frequency Coding (STFC) in order to identify the performance capability of Turbo Code with using a Quaternary Phase Shift Keying (QPSK) modulation technique. Generally, Turbo Code as encoder is functioning to convert the input signal become into a binary form before the modulation happens. The project report focuses on the simulation by the Matlab software. Upon this report, the performance of Turbo Codes as an encoder at the transmitter, and decoder at the receiver by using Space Time Frequency Code (STFC). Matlab Version 7.5 is used to simulate the system. The model consists of transmitter, transmission channel and receiver.

This project also proposes a class of full space diversity with full rate space time frequency codes. Parallel concatenated codes are designed to this project. A lot of theory proposed is employed to check the full space diversity of the codes. The simulations show that the space time frequency codes can take full advantage of space diversity and time diversity if they are available in the channels. This project involved with Additive White Gaussian Noise (AWGN) as a transmission channel. Essentially, this project also studies the robustness of performance by Turbo Codes and compare with the system which excludes the Turbo Code by generating the signal using a similar modulation technique (QPSK). Throughout this project, some finding about the goodness of using Turbo Code in term of Bit Error Rate (BER) and identifying the performance capability of it system.

CHAPTER 1

INTRODUCTION

1.1 Background

The demand for wireless communications has experienced a large growth, which challenged the research community to discover new communication techniques and systems that are capable of providing high data rates. Wireless channels have many physical limitations, such as fading and interference, which prevent reliable communication. In order to combat these limitations and achieve the goal of reliable communication over the wireless links, Turbo Code by implementation of Space Time Frequency block Coding is being used. In this project, it had presented a comprehensive study of Turbo Codes as an encoder and decoder for the systems with transmit and receive antenna diversity introduced in [1], [2]. Digital communication system offer several important advantages with analog system since it have higher performance, greater versatility, higher security and economical. Digital communication system relatively immune to channel noise and interference, gives very low error rate and message can be coded for error detection and correction. The future development for these wireless communication system will driven by high data of applications such as WiMax, Video Conference over wireless links. It require a few order of magnitude higher bandwidth compared to that provided by current wireless standard including CDMA 2000, GSM, as well the 3G mobile system.