Sudan University of Science and Technology

College of Engineering

School of Electronics Engineering

Simulation and Implementation of 8PSK Soft Modem

A Research Submitted in Partial fulfillment for the Requirements of the Degree of B.Sc. (Honors) in Electronics Engineering

Prepared By:

1. Hiba Awad Osman
2. Hussein Abd Almuate Hussein
3. Isra Bashir Osman
4. Mohammed Monir Mohammed
5. Taha Almunzir Awad Osman

Supervised By:

Dr. Rania Abd-Alhameed

Co- Supervised:

. Aman Jacknon and Eng. Abdallh Mustafa

September 2014

الاستهـــــــــــــلال

قال تعالى :

"يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ وَاللَّهُ بِمَا تَعْمَلُونَ خَبِير"

[سورة المجادلة: 11]

صدق الله العظيم

عَن أبي الدَّرداءِ رَضِيَ اللهُ عنهُ قالَ سَمِعْتُ رَسُولَ اللهِ صلَّى اللهُ عليْه وسلَّمَ يَقُولُ:

(مَن سَلَكَ طَرِيْقًا يَبْتَغِي فِيْهِ عِلْمَاً سَهَّلَ اللهُ لهُ طَرِيْقاً إلى الجَنَّة وإنَّ المَلائِكَةَ لَتَضَعُ أجْنِحَتَهَا لِطَالِبِ العِلْمِ رِضَاً بِما يَصْنَعُ وَ إنَّ العَالِمَ لَيَسْتَغفِرُ لهُ مَن في السَّمواتِ ومَن في الأرض حَتَّى الحِيْتَانُ في المَاءِ وفَضْلُ العَالِمِ عَلى العَابدِ كَفَضلِ القمَرِ على سَائِرِ الكَوَاكِبِ وإنَّ العُلَماءِ وَرَثَةُ الأنبيْاءِ وإنَّ الأنبيْاءَ لمْ يُوَرِّثُوا دِيْناراً ولا دِرْهَماً وَ إنَّما وَرَّثُوا العِلْمَ فَمَنْ أخَذَهُ أخَذَ بحَظٍ وَافِرٍ.)

ـ رواه أبو داود والترمذي ـ

DEDICATION

For our parents, who lighted the path for us for all those people who shared with us their knowledge, for our friends, who brightened our days in all kinds of wonderful and magical ways with the most precious things.

For our teachers, appreciating all the hard work you did. For all pure people, who helped and supported us, thank you and God bless you.

To the people of Gaza Champions, Salute to Champions Resistance of Al-Qassam Brigades and the Al-Quds Brigades whofought valiantly Zionist enemy occupies our land of Palestine, congratulations to all the martyrs in Gaza elevated his soul to heaven.

ACKNOWLEDGEMENT

All praises are due to Allah, who taught human everything. And his peace and blessings be on the prophet, his household and all those that follow the truth which he was sent with till the day of resurrection.

Firstly we would like to thank Allah a lot as his almighty has given us a lot, then we would like to thank our supervisorDr. rania Abd-alhameed,co-supervisor Eng. Aman Jacknonand Eng. Abdallh Mustafa for valuable advices and support they had given us in the writing of this report.

I would like to thank our family, especially my parents, for their encouragement, patience, and assistance over the years. We are forever indebted to our parents, who have always kept me in their prayers.

ABSTRACT

This project presents a method to design (8-PSK) soft modulator an demodulator. The method makes use of (DSP) technology.

8-PSK is the highest order PSK constellation deployed; with more than 8 phases, the error-rate becomes too high and hence it’s the best modulation scheme.

The (PSK) modem is first designed and simulated using MATLAB/ simulink to evaluate code performance and test accuracy of system design, then Code Composer Studio (CCS) is used to model and design and simulate used in modelling simulate the (8PSK) modulator and demodulator in target hardware kit soft module; finally the system is implemented by using (DSP) kits which used as a transmitter and a receiver (transceiver).

المستخلص

هذا المشروع يقدم طريقه لتصميم تضمين ازاحة الطور الثماني للمعدل ومزيل التعديل بالأستفاده من تقنية مودم معالج الاشارة الرقميه.

تضمين ازاحة الطور الثماني هو اعلي ترتيب في نشر تشكيل تضمين ازاحة الطور لأكثر من ثمان مراحل , ومعدل تصحييح الخطأ اعلي لذلك فهو أفضل معدل.

تضمين ازاحة الطور الثماني تم تصميمه ومحاكاته اولا" باستخدام برنامجالماتلاب لتقيم اداء الكود واختبار دقة تصمييم النظام ثم عن طريق برنامج خاص تم تصميم المعدل ومزيل التعديل في لوحة عتاديه قابله للبرمجهواخيرا"طبق النظام باستخدام لوحة معالج الأشارة الرقميه الذي يستخدم كجاهز ارسال واستقبال.

List of Contents

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

ADC	analogue-to-digital converters
AIC	analogue input and output codec
AM	Amplitude modulation
ASK	amplitude-shift keying
AWGN	Additive white Gaussian noise
BFSK	Binary frequency-shift keying
BPSK	binary phase-shift keying
BW	Band width
CCS	Code composer studio
DAC	digital -to- analogue converters
DPSK	Differential phase-shift keying
DSK	Digital Signal Processing Starter Kit
EDGE	Enhanced Data rates for GSM Evolution
FEC	Forworld error correction
FIR	Finite impulse response
FM	Frequency modulation
FSK	frequency-shift keying
GMSK	Gaussian Minimum Shift keying
GSM	Global system mobile
IDE	integrated development environment
JTAG	Joint Test Action Group
LCD	liquid - crystal display
LED	Light emitting diode
MFSK	multiple frequency-shift keying

MPSK	multiple Phase-shift keying
OOK	On off keying
OQPSK	Offset quadrature phase-shift keying
PAM	pulse- amplitude-modulated
PLL	Pulse lock loop
PM	Phase modulation
PSK	phase-shift keying
QoS	Quality of services
RS	Received Signal
RX	Reciver
SDR	software defined radio
SDRAM	synchronous dynamic random accses memory
SQPSK	Staggered quadrature phase-shift keying
TDRSS	tracking and Data Relay Satellite System
TX	Transmitter
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal synchronous bus
VLIW	very - long - instruction - word

Chapter One

Introduction

Chapter one

Introduction

1.1 Preface

The process of impressing low-frequency information to be transmitted on to a high-frequency wave, called the carrier wave, by changing the characteristics of its amplitude, frequency, or phase angle is called modulation. the Needed for modulation is message signal or voice signals have low frequencies and cannot travel longer distance approach a technique called modulation.[1]

There are two types of modulation Analogue modulation and Digital modulation, in analogue modulation, the modulation is applied continuously in response to the analogue information signal and the techniques are: Amplitude modulation (AM), Frequency modulation (FM), Phase modulation (PM).

In digital modulation, an analogue carrier signal is modulated by discrete signal and the techniques are based on keying: phase-shift keying (finite numbers of phases are used) PSK, frequency-shift keying (finite numbers of frequencies are used) (FSK), amplitude-shift keying (finite numbers of amplitudes are used) (ASK).

Frequency-shift keying (FSK) is a frequency modulation scheme in which digital information is transmitted through discrete frequency changes of a carrier wave. The simplest FSK is binary frequency-shift keying (BFSK)

and the other type multiple frequency-shift keying (MFSK) its uses more than two frequencies (M is usually between 2 and 64).

Phase-shift keying (PSK) is a digital modulation scheme that conveys data by changing, or modulating, the phase of a reference signal (the carrier wave) is a widely used form of data transmission, well suited for synchronous data communications. For unrestricted bandwidth PSK gives the lowest bit error rate for a given transmitted energy per bit, it is also efficient in the use of bandwidth. The basic PSK system, for binary data, transmits one of the two phases of a carrier signal, depending on the sense of the bit transmitted.

The type of Phase-shift keying (PSK) is: binary phase-shift keying" (BPSK) which uses two phases, multiple Phase-shift keying (MPSK) and quadrature phase-shift keying (QPSK) which uses four phases and Divided into: Offset quadrature phase-shift keying (OQPSK) also know Staggered quadrature phase-shift keying (SQPSK) that (Using 4 different values of the phase to transmit), and (π/4–QPSK) that (uses two identical constellations which are rotated by 45° radians with respect to one another Usually, either the even or odd symbols) from the other constellation. [2]

Modem is shorthand for Modulator Demodulator; it's come in two styles External (These modems set outside your computer and are connected to it via cables), Internal (These boards are mounted inside your computer); it's come in two types Soft-Modems (Sometimes called Win-Modems) and Full-Modems (sometimes called Hardware-Modems), Soft-Modems or (Win-Modems) are a minimal design, which uses much of your computer's (CPU) power to receive and send data. These minimally designed modems are much cheaper to build than a Hardware-modem. [3]

1.2 Problem Statement

The hard modems have some problem which can be represented in high Bit error rate

- Flexibility and it require many code modems.
- High speed implementation.
- High cost.
- Synchronizations.

1.3 ProposedSolution

In this project design and implementation of 8psk soft modem isproposed to solve the motioned problem.

The Soft-Modems are minimal design that increases the flexibility and enable the system to be reconfigured based of the desired requirements.

1.4 Research Aim and Objectives

The Aim

Simulation 8psk modulation and demodulation soft modem use kit (C6713 DSK).

The objectives

1. To Study theoretical and practical knowledge about 8psk soft modem and to identify available methods and technique for 8psk modulation, demodulation and corresponding circuits.

2. To Design and simulate 8psk modulation, demodulationalgorithms using Matlab, and establish a suitable process for implementing them in the (TX/RX) system.

3. To simulate the design using CCS and implement and test the system using kit (C6713 DSK).

1.5 Methodology

In this project we use three types of methodology approaches:

Firstly, we used mathematical approach to determine (the modulation and demodulation of 8/psk)

Secondly, the software approaches to simulate and realize directly 8-PSK modulator and demodulator by using the MATLAB R2008a.

Thirdly, hardware implementation using appropriate digital signal processor implementation on one DSP kits acting as transmitter and receiver. The Description of C6713 Floating Point DSP Starter Kit (DSK) is a low-cost development platform designed to speed the development of high precision applications based on TI´s TMS320C6000 floating point DSP generation. The kit uses USB communications for true plug-and-play functionality. Both experienced and novice designers can get started immediately with innovative product designs with the DSK´s full featured Code Composer Studio™ IDE and express DSP™ Software includes DSP/BIOS and Reference Frameworks.

1.6 Outline of the Thesis

The project consists of five chapters each and every chapter:

Chapter one: is an introduction that gives a background about the project, its aims and objectives, the problem statement and proposed solutions. It also gives a brief description on how to achieve those goals in the methodology.

Chapter two: is a literature review, Literature review's chapter categorized into domain research and technical research. The domain looks for the comparable systems, Wireless network, and encryption. On the other side, the technical research investigates on software methodology, also the programming language, project components and the prototype design.

Chapter three: is system design, components selection, and covers the simulation design for the project, Implementation of the project.

Chapter four: Are results and discussion, offers the system testing and all results also the discussions includes simulation parameters, an explanation of the simulation.

Chapter five: conclusion and recommendations, Conclusion of the project and suggestions for future work.