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A STUDY ON MATLAB GUI BY USING BINARY BASEBAND COMMUNICATION SYSTEM

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Abstract— This paper presents the MATLAB Graphical User Interface (GUI) mainly used in digital communication and electromagnetics. GUI is powerful tool which is available on MATLAB. It is basically used to design app, which can share live script with others via MATLAB Offline or Online. The MATLAB GUI used to design modules which results in simulation of baseband digital communication system and determines transmission of the Binary Phase Shift Keying signal (BPSK) amid Additive white Gaussian noise (AWGN) channel along with tone jamming background. To reduce the effect of jamming, digital notch filter at the receiver are used. The results of the simulated design modules shows the dissimilarities of the signal corresponding on every section of the communication system. A comparative analysis is done based on illustrated figure. This research also shows the observation and tests by using GUI requires less time as compared to command line interface (CLI) version.

Keywords— MATLAB, Graphical User Interface (GUI), Digital Communication System, BPSK, Noise.

I. INTRODUCTION

Engineering profession is the occupation to manipulate the materials, source, information and their evidences in such a way that it can be in the interest of humankind [1]. As we know that in present day's engineers have more theoretical knowledge as compared to practical and conceptual knowledge. To have theoretical based education system, students also want conceptual knowledge for better understanding. Such problem can be solved by the practical knowledge. Therefore as much as theoretical classes are necessary as practical classes are also necessary. Students can get important practical knowledge and have familiarity towards the subject in laboratory. When the students perform

experiments in laboratory, some students need more experiments to understand the conceptual knowledge. To resolve such type of issue, virtual educational system can be used with the help of several multimedia tools. Introducing the MATLAB to the students, which is one of the best learning

Software in the world for students and researchers to work on their projects and perform their experiments to simulate them virtually for better understanding, it can be downloaded or its online version is also available. In MATLAB there is tool called Graphical User Interface (GUI). The reason of taking GUI compared to other virtual tool is that it is more fast and accurate. So that, MATLAB graphical user interface (GUI) is used, where in this we use graphical icons, pull-down menus, buttons and scrolling techniques to reduce time and amount of typing. It does not require typewriting the command line statements for desired results, but then also we get same experiment outcomes, This is the main advantage of MATLAB graphical user interface (GUI) tool and popular in users.

The rapid advancement in digital communication, we need to look for automated system for analyzing the outcome of digital modulation by the use of MATLAB/Simulink software. Mainly the basic modulation techniques are Quadrature Amplitude Modulation (QAM), Amplitude Shift Keying (ASK), Phase Shift Keying (PSK), and Frequency Shift Keying (FSK). The QAM is very popular modulation techniques reason is its capability in bandwidth and power. In the QAM technique, two signals of amplitude-modulated (AM) are used and combined into a one channel, where by doubling the effectual bandwidth power.

For better signal-to-noise ratios (SNRs) maintain certain bit error ratio (BER). In MATLAB programming we use to simulate the transmission of the baseband digital signals of Binary Phase Shift Keying (BPSK) over AWGN channel with a tone jamming signal interference and reducing jamming effect by use of notch filter on receiver side. In this research we propose MATLAB GUI simulator for baseband digital

communications system based project. The main aim for developing graphical user interface (GUI) to know the outcomes of communication system with the help of BPSK modulation technique within faulty channel.

II. DIGITAL BASEBAND COMMUNICATION SYSTEM

As shown in the figure below the block diagram of digital baseband communication system is proposed, it is basically based on/uses the Binary Phase Shift Keying (BPSK) modulation technique. There are three main parts of the given model consist of the different module, first is called transmitter having sub-system of data bits which is used to transmit the source data to impulse modulator, where the modulation of the signal is done and replaced by a series of impulses, so that the data bits for waveform encoding by stuffing zero sample values between the input signals and last is Sample Rate Conversion (SRC) where, only two options are available to choose the pulse shaping functions to produce the actual waveform before the data bits are transmitted signals are improved by the pulse shaping function,. the channel, it carry information of the data signal which is combined with and sent to a normal Additive White Gaussian Noise (AWGN) channel with a single sinusoid waveform called jamming tone and noise, at last the receiver system where as shown in below, in this there are three subsystems, a notch or jammer or a nulling filter, second is the matched filter and last is the bit decision maker. The effect of tone jammer in the presented interference is lowered with the help of notch filter. The corresponding matched filter is used to optimum tolerance for noise in the system. Finally bit decision whether to choose or reject the sample data bits, the chosen bits are called received data bits converted to a pure binary in the sequence of plus minus one.

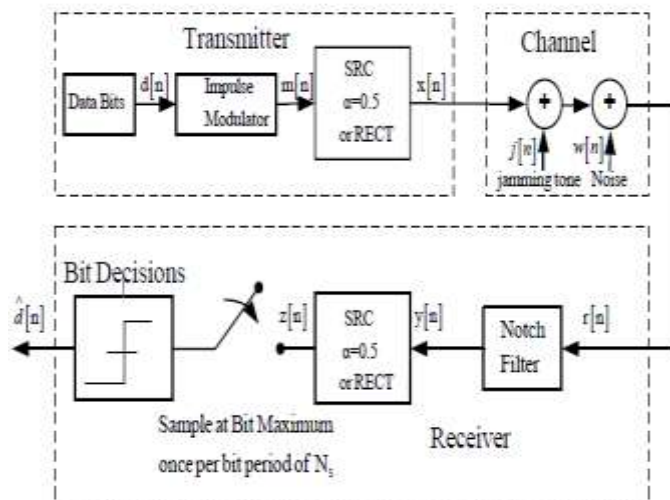


Figure1. Block diagram

III. THE GRAPHICAL USER INTERFACE (GUI)

The Graphical user interfaces (GUIs), also called app which can be designed in MATLAB. It is one of the best tool in MATLAB that provides point and click control to our software application; it can end the requirement of master other language to design an app. We can share our designed app within MATLAB, separate desktop as well as on other web apps. It is designed and built based on figure 2 shows the process for creating GUIs in MATLAB. Whole design operation is divided in two main parts. In first is called design process and other is known as implementation process. In design process, it begins with the design task where the process starts with in design phase that consists of defining a task in this bar, drawing GUI and testing the design. After that it goes to next process is the implementation phase, it consist of the writing a code and test code, so that we can test our designed code. Then after successful and desired outcomes achieved, the process comes to end.

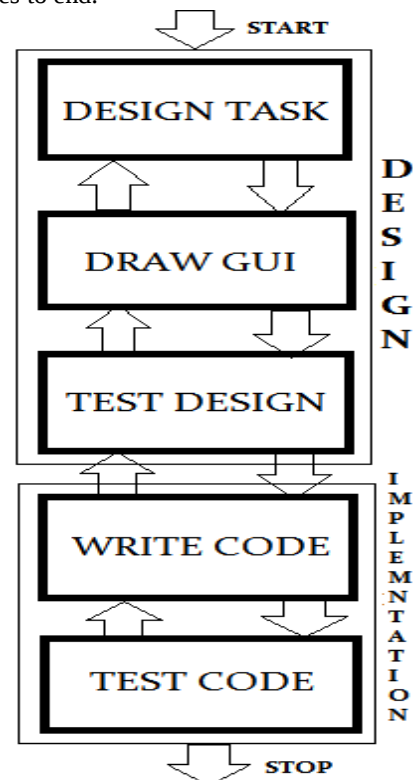


Figure 2.The process of creating Graphical User Interface (GUI) line diagram

IV. GUI MATLAB PROCESS

For the design of app it integrates with two different task first is laying out the visual components of GUI and other is the programming app behaviors.

I. GUI MATLAB Process

In this process, there are two different processes known as design module and implementation system. These modules are

further classified into sub systems where in design module consists of design task, draw GUI and test design and in the second module subsystem are to write code and test modules.

A. Design Task

To get the desired outcomes as disused in digital baseband communication system, in figure 1 input parameters used in the system with interferences and notch filter reducing effect jamming. An outcome of the system shows the different types of corresponding plots to the output signal at every position of the system model. The binary communication system over distorted channel, input parameters given number of bits to simulate (Nbits), then the number of samples per bit in the waveform simulation denoted by (Ns), third is the jammer frequency given by (fj), next is signal to interference also known as jammer ratio denoted by SIR dB last is the signal to noise ratio in SNR dB. One more input parameter consists of IIR notch filter to control jamming effect, also angular frequency given by ω_0 , distance from the pole position in unit circle (r), and total number of bits in the quantizer (Btot). Two types of pulse setting system for transmitted signals, RECT and square-root raised cosine (SRC) with $\alpha = 0.5$. At last, output responses in various kinds of plots such as time-domain plot, frequency-domain plot, eye-plot, bit-error probability (BEP) waterfall curve, and filter characteristics plots such as frequency response plot, and pole-zeros plot.

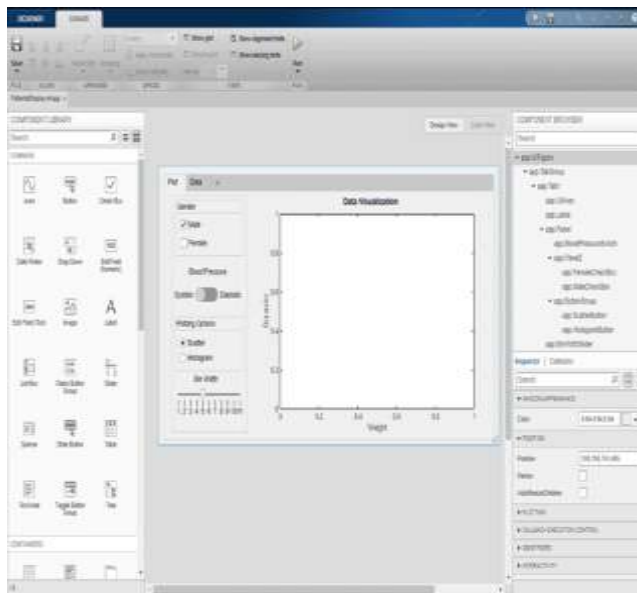


Figure 3 Graphical user interface (GUI) tool in MATLAB

B. Draw GUI

In GUI drawing process, it consists four major sections known as two input sections, output section and information section. The first input section, shows the system with interferences of the model and the filter characteristic and second input section shows the selection of output responses which displayed on

the plot area. Than output section shows, plot area for the output responses and last is the information section shows the outcomes of system description.

C. Test Design

Last is the testing of the design after drawing of GUI. It is also called performance test. We can run design tests to make sure about code performance. The output responses of the bit error probability (BEP) waterfall curve of the system with interference.

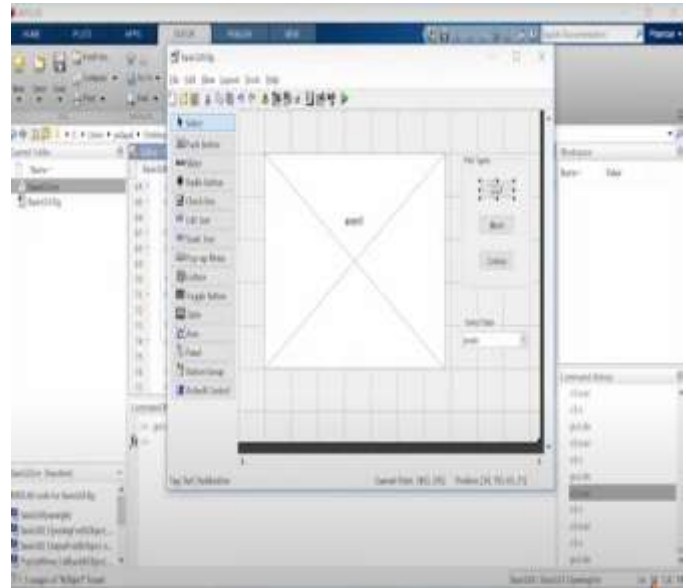


Figure 4 Graphical user interface layout

Implementation

This module consist two main parts called write code and test mode. Where in write code the different model functions are used to run the system model and after completing the model function codes are tested for desired outcomes.

A. Write code

Writing codes in the GUI MATLAB to execute the process of creation of system. Writing has the main two parts, used to create display layout and callback. Layout designed with the help of GUIDE (Graphical User Interface Design Environment) it is basically a MATLAB tool called GUI. It has the layout a tool makes it simple for creation and drafts the handle graphic objects easily.

B. Test the code

Whether callback's operation writing codes which performs behind the scenes. The callback is the MATLAB functions used in GUI which shows the simulation of digital communication system. While writing codes in the GUI for the given digital communication system output layout is given in the Figure 4, tested until desired output. It can be achieved

by running program with input parameters and comparing the output results from the GUI with the results from the MATLAB command line.

V. RESULTS

The layout results of the system under different responses are given for Baseband Binary Communication over Distorted Channel responses in figure 5, Frequency Domain responses in figure 4 and BEP performances in figure 6.

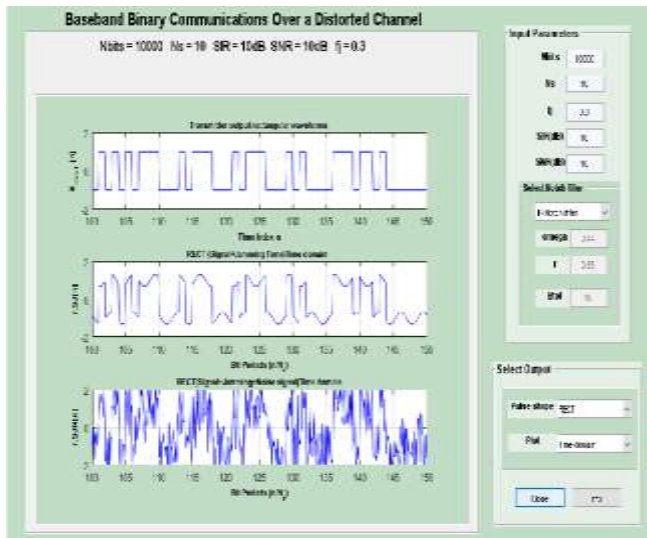


Figure 5 Baseband Binary Communication over Distorted Channel responses.

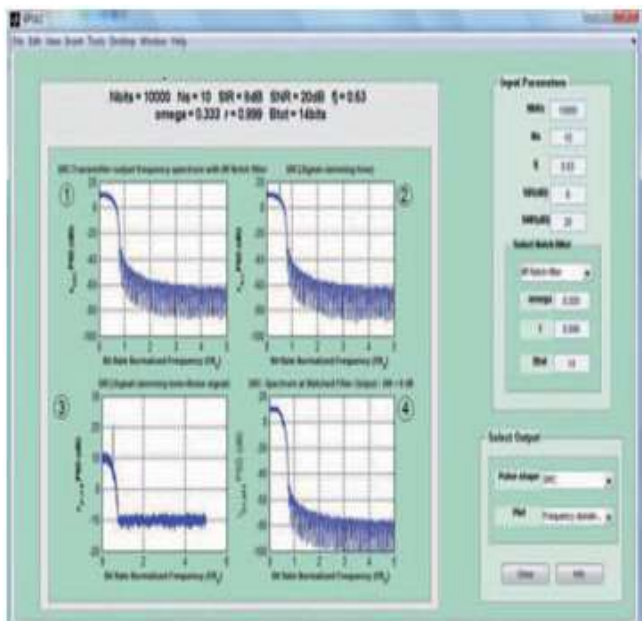


Figure 6 Frequency Domain responses.

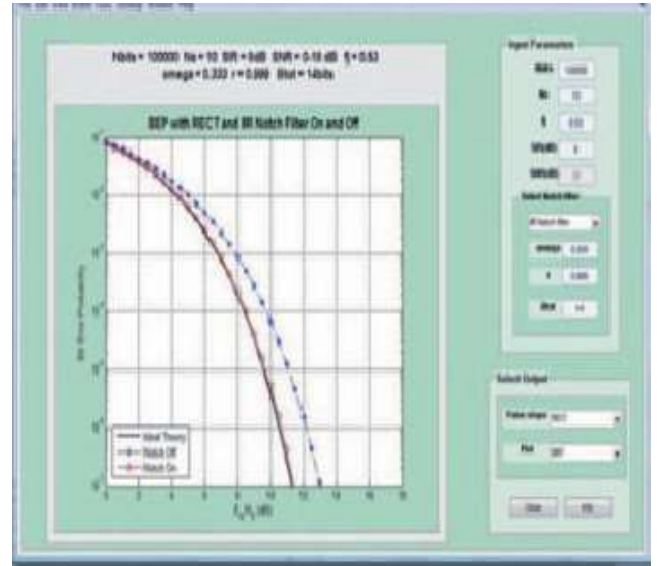


Figure 7 BEP performances.

VI. CONCLUSION

In this research the MATLAB GUI simulator is used in baseband digital communication system. Our GUI design has digital communication system transmitter, channel and receiver, which is designed and simulated. Given channel have AWGN and jamming tone. To control the effect of jamming tone and noise, notch filter is used at the receiving end. GUI output shows the results of Baseband Binary Communication over Distorted Channel responses, Frequency Domain responses and BEP performances. Notch Filter characteristic is plotted in the pole-zero plots. Its output responses of GUI is fast as compared to others.

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