FM MODULATION AND DEMODULATION MODEL USING SIMULINK

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ABSTRACT

In radio communication, Frequency modulation (FM) is the method of conveying information over a carrier wave by varying its frequency. This method is widely used in telecommunication devices to transmit voice without disturbances. In analog applications, the instantaneous frequency of the carrier is directly proportional to the instantaneous value of the input signal. Digital data can be sent by shifting the carrier's frequency among a set of discrete values, a technique known as frequency-shift keying.

FM radio is one of the most prevalent forms of media communication in the world today. As listeners all over the world continue to buy and use FM radios, designers for portable devices such as MP3 players and mobile phones are increasingly including FM radio capability in their products. Understanding the basics of FM radio will assist designers in creating high performance products, be it traditional standalone radios, next-generation, or multi-use devices.

FM channels are designed to allow carrier frequencies between 88 and 108MHz, each radio station is assigned 200 KHz, to transmit a stereo audio. The left and right channels (each limited to 15 KHz) are multiplexed into a single baseband signal using amplitude modulation. FM frequency is widely used in telecommunication devices to transmit voice without disturbances.

Keyword: - *FM(Frequency Modulation , Shifting,Keying*

1. Introduction

Today simulation is an important domain which attracts many researchers from several fields and disciplines.

Simulation software is based on the process of modelling a real phenomenon with a set of mathematical formulas. It is essentially, a program that allows the user to observe an operation through simulation without actually performing that operation. Simulation software is used widely to design equipment so that the final product will be as close to design specification as possible without expensive process modification. Simulation has proven to be a powerful tool in modelling a complete communication channels before embarking on the real prototype. In recent years, extensive research has been conducted in the area of simulation to model large complex systems like FM and understand their structures and behaviors. At the same time, a variety of design principles and approaches for computer- based simulation have evolved. As a result, an increasing number of computer simulation sub-fields and approaches have been proposed, as well as a large number of tools and applications having been designed and

developed. The benefits of computer simulation are becoming more generally recognized in several domains and areas.

Some of the computer software packages usually used by Engineers for analysis and simulation of physical systems include: MATLAB/SIMULINK, RMxprt/Maxwell2D/3D, SIMPLORER, HFSSV10, XFDTD/Varipose/XGTD, COMSOL, 5SPICE, ANSYS, Electronic Workbench etc. The availability of these computer software packages is now reshaping the role and applications of computer laboratory projects to involve students in more intense problem-solving experience. These user programs also provide an opportunity to easily conduct numerical experiments and to tackle realistic and more complicated problems.

In this research, we studied Frequency Modulated radio channel, modeled and simulated it using MATLAB and SIMULINK tools to predict adequately its performance and behavior.

2. Description

Modern engineering would be inconceivable without computers to gather data and run model simulations. Whether it involves bringing back pictures of the surface of the planet Mars or detailed images to guide brain surgeons, computers have greatly extended our knowledge of the world around us and our ability to turn ideas into engineering reality. Modelling is the process of generating abstract, conceptual, graphical and/or mathematical models. Science offers a growing collection of methods, techniques and theory about all kinds of specialized scientific modelling. A model in general is a pattern, plan, representation (especially in miniature), or description designed to show the main object or workings of an object, system, or concept. Simulation is used in different ways by different people. As used here, simulation is defined as the process of creating a model (i.e., an abstract representation or exact copy) of an existing or proposed system (e.g., a project, a business, a mine, a forest, the organs in your body, etc.) in order to identify and understand those factors which control the system and/or to predict (forecast) the future behavior of the system. Almost any system which can be quantitatively described using equations and/or rules can be simulated.

The underlying purpose of simulation is to shed light on the underlying mechanisms that control the behavior of a system. More practically, simulation can be used to predict (forecast) the future behavior of a system, and determine what you can do to influence that future behavior. That is, simulation can be used to predict the way in which the system will evolve and respond to its surroundings, so that you can identify any necessary changes that will help make the system perform the way that you want it to. Thus modelling and computer simulation are important interdisciplinary tools.

2.1 Computer Simulation

Gaines in stated a number of good reasons for using computer simulation as a problem-solving tool. In the following points, we list the main reasons:

(1) The physical system is not available: Often, computer simulations are used to determine whether or not a projected system should ever be built; so obviously, experimentation is out of the question. This is common practice for engineering systems (e.g., an electrical circuit) with well-established and widely applicable meta-knowledge. It is rather risky to rely on such a decision in the case of systems from soft science (the so-called ill-defined systems) since the meta-knowledge available for these types of systems is usually not validated.

(2) The experiment may be dangerous: Often, simulations are performed in order to find out whether the real experiment might 'blow-up', placing the experimenter and/or the equipment under danger of injury/damage or death/destruction (for example, an atomic reactor, or an aircraft flown by an inexperienced person for training purposes).

(3) The cost of experimentation is too high: Often, simulations are used when real experiments are too expensive. The necessary measurement tools may not be available, or are too expensive to buy. It is possible that the system is used all the time, and taking it 'off-line' would involve unacceptable cost.

(4) The time constants of the system are not compatible with those of the experimenter: Often, simulations are performed because the real experiment executes so quickly that it can hardly be observed (for example, an explosion), or because the real experiment executes so slowly that the experimenter is long dead before the experiment is completed. Simulations allow us to speed up or slow down experiments at will.

(5) Control variables, and/or system parameters may be inaccessible: Often, computer simulations are performed because they allow us to access all input (variables), whereas, in the real system, some inputs may not be accessible for manipulation.

3. Simulink Model of FM Modulation Using Matlab

Different SIMULINK blocks are included to form the complete model for an FM system. In this model, a simple MATLAB Module shown below is used as input to SIMULINK. This Module provides the carrier angle and message signal to the SIMULINK block

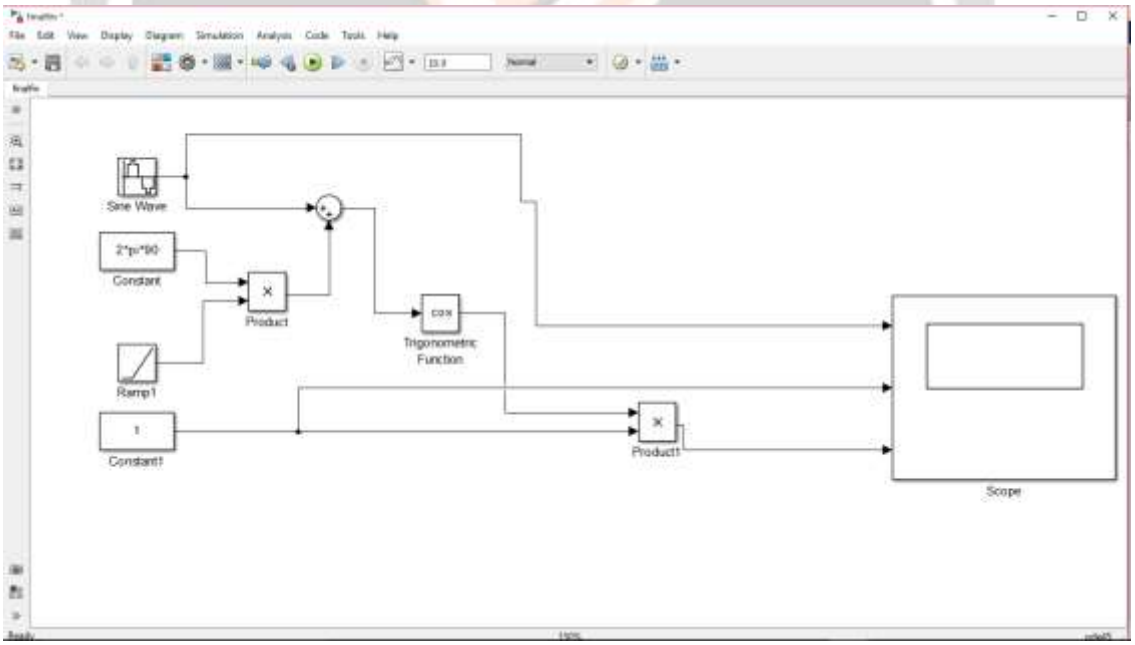

Fig 3.1: FM Modulation Using Simulink

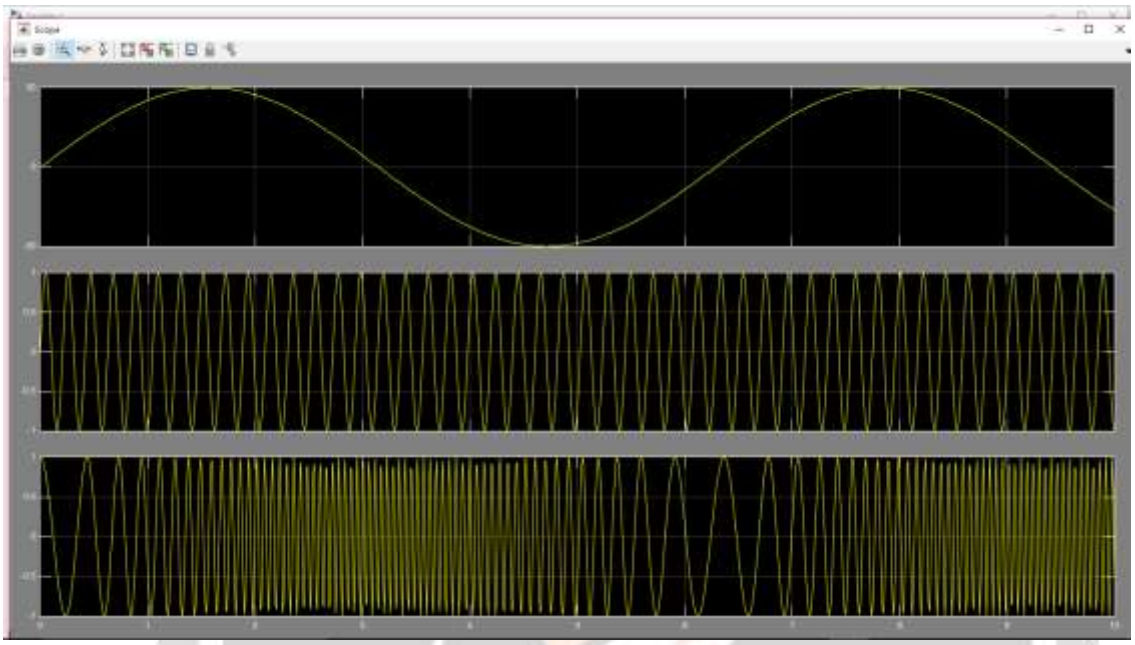

Fig 3.2:Output of FM Modulation Using Simulink

3. 1Simulink Model of FM De-Modulation Using Matlab

There are a number of circuits that can be used to demodulate FM. Each type has its own advantages and disadvantages, some being used when receivers used discrete components, and others now that ICs are widely used.

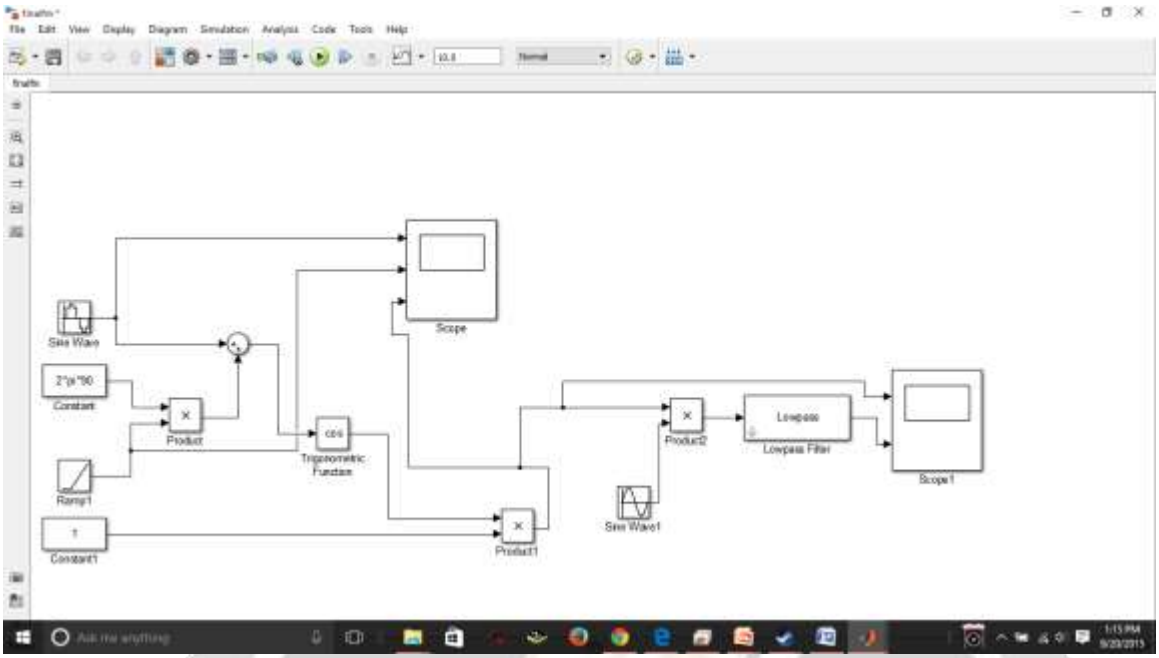

Chart -2: FM De-Modulation

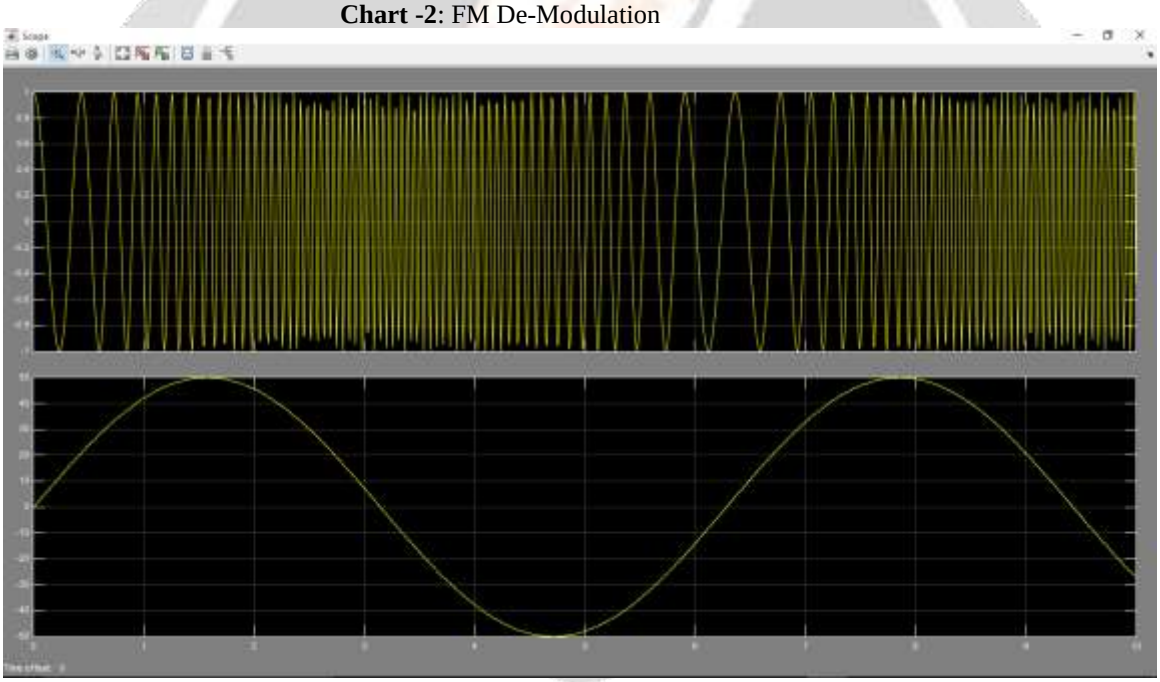

Fig -2 Output of FM De-Modulation

4. CONCLUSIONS

a. The data Attenuation can be substantially reduced while travelling long distances in communication.
b. The Software Implementation gives us an advantage of reduction in hardware cost and failures.

5. ACKNOWLEDGEMENT

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