Atharva Digital Modulation Technique

Rachana B. Nair

Independent Researcher

***Abstract*— The proposed modulation technique employs quadrature mixing to achieve transmission of high frequency data over a narrow channel. In this modulation technique, the phase of carrier is varied in accordance with the instantaneous amplitude of the message signal. The message data bits are transformed to an unintelligible form which then modulates a carrier signal. The modulation technique induces probabilistic characteristic over the entire process. The nondeterministic nature of data is enhanced and thereby providing integrity and confidentiality to the data which is transmitted across a channel. Another important feature of this technique is that prediction of the message data bits by observing the modulated signal is foiled due to the use of different phase shifts for 40 symbols. In this technique, the spectrum of modulated signal is translated to be centered at 0 Hz. At the demodulator, the instantaneous amplitude and phase can easily be determined. The major advantage of this digital modulation technique is that, signaling rate, requirement of high frequency carrier and transmission channel bandwidth is reduced to a considerable extent without compromising the transmission capacity and data rate.**

***Keywords*— Atharva, digital modulation, quadrature mixing, signaling rate, transmission capacity.**

I. INTRODUCTION

Communication is an integral essence of mankind. Over the past century, lot of advancements has been made in this branch of Engineering, paving way for increased ease of life and comfort. A significant development in telecommunication arena has enabled the transmission and reception of information bearing signal an easy task. The inventions of electric battery, telegraph, telephone, triode amplifier , theories formulated in the field of electromagnetic field theory by Oesterd, Faraday, Gauss , Maxwell and Henry laid the foundations of Communication Engineering and Systems. Coherer, an electronic device which could detect the presence of radio signal together with the invention of wireless telegraphy by Marconi, vaccum diode and vaccum triode marked the beginning of telecommunication era [1]. Communication systems can be broadly classified as pass band transmission systems, satellite communication systems and optical communication systems. Elements of communication systems include source which generates message signal that is to be transported from source end point to destination end point. Information may be audio signal, video, images or text data in English , French etc. Information of varied forms has to be converted to an electrical signal by a transducer in order to transmit it across the communication medium. Similarly, at the receiver end point we require a transducer in order to translate the received electrical signal to the original form of data which was generated by the source . Basic building blocks of communication system includes transmitter, channel and receiver.

Transmitter is an element which converts electrical signal to a form ensuring the achievement of desired SNR ratio during the propagation of signal across the transmission media. The electrical message signal is translated to a higher frequency range by means of a technique called modulation. The characteristic of the carrier signal is varied in accordance with the instantaneous amplitude of message signal. The transmitter matches the signal to the channel by modulation. Channel is a medium across which the modulated signal propagates and gets corrupted by noise and various other interferences like thermal noise, electromagnetic interferences and stray capacitances leading to depreciation in signal quality.

Irrespective of the type of transmission medium the signal is bound to get corrupted by noise. While designing a system ,care should be taken to ensure that the system is robust to distortions and interferences generated due to various possible mechanisms.

Receiver is used to detect the message signal from the received modulated signal degraded by the presence of noise. The noise suppression and signal filtering needs to be done. The noise free amplified signal undergoes demodulation to reproduce the original message signal. Fidelity of the system depends on the type of modulation, channel, additive and non – additive noise. When the modulating signal is discrete in nature then digital modulation technique is used. The carrier signal is a high frequency continuous sinusoidal waveform. If the data bit is 0 then $S_1(t)$ is transmitted and $S_2(t)$ is transmitted for bit 1. S_1 (t) is a low frequency signal continuous signal compared to $S_2(t)$. Though the modulated signal appears to be continuous, the modulation is discrete.

Satellite communication system provides multiple access capability and distribution capability. It is also flexible to changes in traffic and network architecture.

Ease of operation and putting into service are other important features of satellite communication systems. Fibre optic communication systems are light wave systems that use optical fibre for transmission. High information capacity and

transmission bandwidth has led to wide spread deployment and development of optical communication systems.

Encryption is a technique to transform an intelligible data to an unintelligible form. Encryption is incorporated along with the pass band transmission system to enhance the data integrity, confidentiality and security of data thereby thwarting attacks from adversaries.

Atharva modulation scheme has integrated the encryption technique with complex mixing to provide an innovative counterpart among the existing pass band transmission systems.

II. PROPOSED DIGITAL MODULATION TECHNIQUE – ATHARVA

The information content is in English language which is converted to binary form and data bits are appended to make the digital data 160 bits in length. If the number of data bits is greater than 160 bits then make the length of data an integer multiple of 160 .

Step 1: Divide the 160 bit block into 5 sub blocks of 32 bits each. Each 32 bit sub block is xored with a random data of 32 bits. Five random data of 32 bits is kept in secrecy between the communicating entities. The output after xoring operation are A ,B,C, D and E respectively.

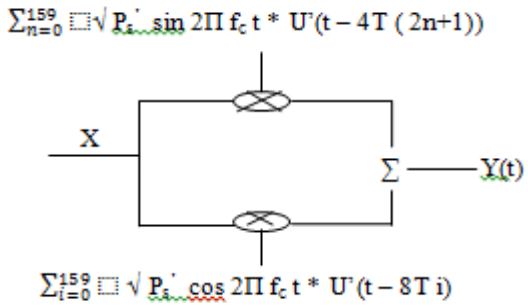
Step 2: A|| B|| C|| D || E =Z . Z is 160 bit in length. The digital data Z is coded by means of line coding technique called Polar NRZ , where 1 is represented by amplitude level 1 and 0 is represented by amplitude level -1. So, we have transformed the digital data comprising of 1's and 0's as a Polar NRZ code signal. The obtained signal , X is applied as an input to the product modulator 1 whose another input is $\sum_{n=0}^{159} \sqrt{P_s'} \sin 2\Pi f_c t * U'(t - 4T(2n+1))$

where U'(t) =U(t) – U(t- 4T) , T is the bit interval. The second product modulator has two inputs a) X.

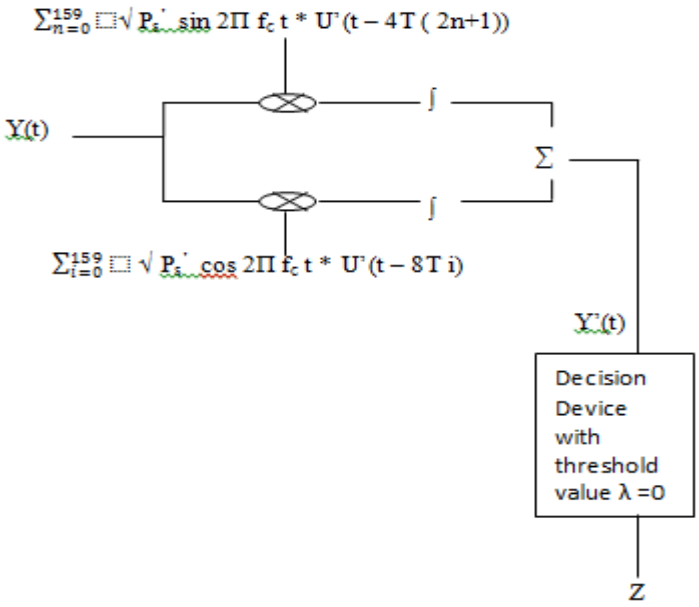
b) $\sum_{i=0}^{159} \sqrt{P_s'} \cos 2\Pi f_c t * U'(t - 8T i)$. P_s' – Average Normalized Power.

The output of product modulator 1 and product modulator 2 is given to a summer to produce Y(t) , which is the modulated signal. The above mechanism is illustrated below: There are 40 symbols of 4 bits in length. The symbols irrespective of its constituent data bits undergoes a phase shift of 0 degree, the remaining 39 symbols experiences a phase shift of -15Π/2 , -16 Π , -47 Π/2 , - 32 Π , - 79 Π/2 , -48 Π, -111 Π/2, -64 Π, -143 Π/2, -80 Π,-175 Π/2, -96 Π,,-207 Π/2,-112 Π, -239 Π/2, -118 Π, -271 Π/2 ,-144 Π, -303 Π/2, -160 Π,-335 Π/2, -176 Π,-367 Π/2, -192 Π, --399 Π/2, -208 Π, -431 Π/2, -264 Π ,-463 Π/2, -240 Π, -495 Π/2, -256 Π, -527 Π/2, -272 Π, -559 Π/2,-288 Π,-591 Π/2, -304 Π, -623 Π/2.

Modulation:



Demodulation:



Y(t) is demodulated as depicted in the above figure to generate an output Y'(t) which is given as an input to decision device with a threshold value ,(λ =0). If the detected signal has an amplitude value > λ then the output of decision device is 1. On the other hand, if the demodulated signal has an amplitude value ≤ λ , the output of decision device will be 0.

Later , output of decision device ,Z = A || B || C || D|| E is xored with its corresponding random number to generate the 160 bit length message signal.

III. CONCLUSIONS

The proposed technique is simple and easy to deploy. Data encryption enables only permitted detectors to modulate the transmitted data. Digital data transmission enables tolerance to large amount of noise. High data rate over a narrow channel exhibiting enhanced non deterministic by the incorporation of complex mixing is achieved in this proposed digital modulation technique.

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REFERENCES

[1]. Digital Communications Fundamentals and Applications Second Edition : Bernard Sklar