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Performance Analysis of PAM and PPM in Communication System

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Abstract— In modulation system input signal goes to the modulator with carrier signal for mixing or transmitted signal. Because of modulation the signal can travel in long distances, ignore great attenuation. The modulated signal is stronger than the applied signal or input signal. In modulation, there are various types according to the nature of the noise signal. Actually, it depends on the practical application. In this research take the low-frequency analogical nature an input signal (for example the people's voice) and the high-frequency digital nature of a carrier signal (for example the clock signal). For simulation authors use simulate signals modulated in amplitude (PAM, Pulse Amplitude Modulation), and in position (PPM, Pulse Position Modulation). On an illustrative basis, authors have simulated the case of an audio(Voice) input signal. Authors analyze acquired results from simulation and recall advantages, disadvantages and applicability of each type of modulation. The modulation software used is MATLAB 2007. This paper notice that acquired outcomes of PAM and PPM from simulations in Variable Characteristic of the Pulsed Carrier is respectively amplitude and position. Also, we observe that the simulation starts late and that the exit is not in conformity with the PAM signal. The pulses are broad, the amplitude of the modulated signal changes with that of the input signal. In the PPM signal authors look that the duration of the pulse is constant and is fixed by the mono-stable one. The pulses amplitude and width are holding constant in this system, whereas the position of each pulse, compared to the position of a reference pulse, is modified by the instantaneous sampled value. The PPM modulated signal can be obtained by differentiating PWM modulated signal to produce narrow pulses (PPM).

Index Terms— PAM, PPM, UWB, OOK, TDM, L-PPM, FSO

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1 Introduction

The communication system becomes ever-more im-portant and necessary parts of our everyday life; sys-tem capacity and quality service issues are becoming more critical. In order to increase the system capacity and improve the quality of service, it is necessary that we pay closer attention to bandwidth and power efficiency issues. In this paper, the bandwidth and power efficiency issues in Free Space Optics(FSO) transmissions are addressed un-der pulse position modulation and pulse amplitude modula-tion schemes, and their performance in terms of power and bandwidth efficiencies. The technique of modulation, which requires a transposition of the low frequencies towards the high frequencies, is employed during the transmission on long distances: It is the narrowband transmission. To transmit a useful signal which is generally low frequency on long distances we use another signal called carrier signal to transpose its frequency towards high frequencies.

In this article, we will study PAM, and PPM modulations. In these types of modulation, the useful signals of analogical form while the carrier signals is a pulse resulting from a clock. These two signals (useful and carrier) arrive in a modulator who will give at its output the modulated signal (PAM, PPM). The analysis of the simulation results allows us to determine the advantages, the disadvantages and the applicability of the various types of modulation. Let us men-tion that obtained results from the simulation are little dif-ferent from those of the real world because of the perfor-mance of the used software and other environmental pa-rameters

2 Literature Review

Zhang and Gulliver(2004) stated that Pulse amplitude modulation (PAM), pulse position modulation (PPM) or On/Off Keying (OOK) modulation is employed in an Ultra Wide Band system. PPM modulation uses the nearest ar-rangement of the impulses in time to convey information, while PAM and On/Off Keying use amplitude for this pur-pose. UWB systems with PAM and PPM modulation have been broadly investigated [5]. Da-shan Shiu and Joseph M. Kahn (1999) stated that Pulse amplitude modulation In the Ultrawideband system can be accessed in various ways which are Pulse amplitude and Pulse Position Modulation. All digital access system based in PPM and TDM was pro-posed in those papers. They actually told about PAM, TDM, and PPM access systems and their performance. They want to tell, also PPM used for the nearest arrangement that means PPM is given more precise value than PAM. Pulse-position modulation(PPM) is a technique that achieves very good average-power efficiency and is widely used in these applications. For example, the infrared data association (IrDA) has designated 4-PPM as the standard modulation technique for 4-Mb/s serial data links [2]. Audeh, Kahn, And Barry(1996) stated that Many applica-tions of non-directed IR links require high average-power efficiency to minimize ocular hazards and power consump-tion. We consider low pulse position modulation (L-PPM) a technique that yields an average-power efficiency im-provement with increasing order L [1]. Sushchilk and et al. (2000) stated that at the expense of the performance loss, CPPM improves communication privacy, spectral charac-teristics, and detection resistance compared to convention-al impulse communications. From the electronics design point of view, incorporating these features using chaos does not lead to a significant increase in design complexity or power consumption. As a number of improvements to CPPM are currently being studied, to the best of our

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knowledge, CPPM already performs extremely well, compared to other chaos-based communication systems. This makes CPPM a prime candidate for the development of practical chaos-based covert spread spectrum systems [4]. Rouissat, Borsali, and Chick-Bled, (2012) stated that Pulse Position Modulation (PPM) is a modulation technique proposed mainly to increase transmission efficiency in the FSO systems.PPM is known for its power efficiency, but the PPM based systems suffer from the disadvantage of bandwidth expansion and high complexity in implementation (due to a higher level of accuracy required in slot and symbol synchronization). Also told Pulse amplitude modulation, acronym PAM, is a form of signal modulation where the message information is encoded in the amplitude of a series of signal pulses, When bandwidth efficiency is taken into account PAM is a prime candidate, for this reason, PAM has been combined with various modulation schemes compatible with the optical wireless systems in order to achieve more spectral efficiency and improve the data rate as well [3].

3 Research Methodology

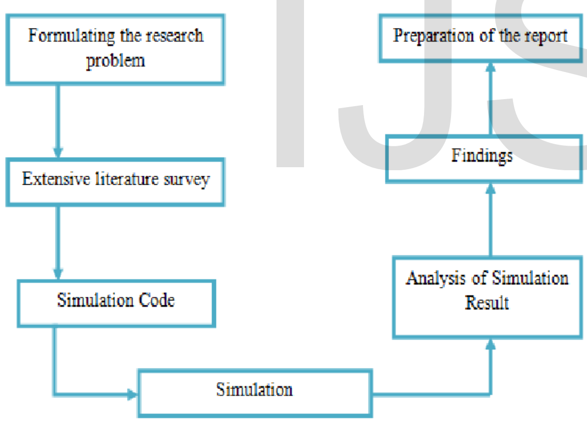

Figure 1: Methodology steps

According to these following steps we do our research. At first, we formulate the research problem, then we read some literature then we simulate the code on MATLAB 2007 software. After that, we get simulation results and find out some important things. Then we prepare this paper.

4 Simulation Result

PAM Simulation Result

Here,
Carrier Frequency = 20
Message Frequency = 2
Sampling Frequency = 1000

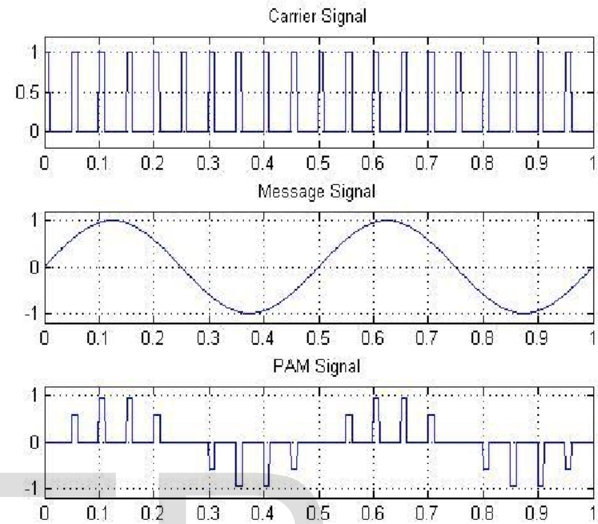

Figure 2: Simulated result of PAM 1

And,
Carrier Frequency = 20
Message Frequency = 2
Sampling Frequency = 2000

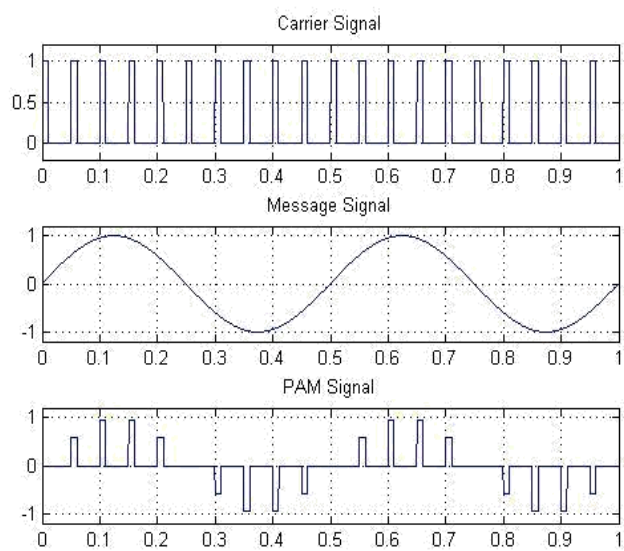

Figure 3: Simulated result of PAM 2

International Journal of Scientific & Engineering Research Volume 10, Issue 7, July-2019
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Carrier Frequency = 50
Message Frequency = 2
Sampling Frequency = 1000

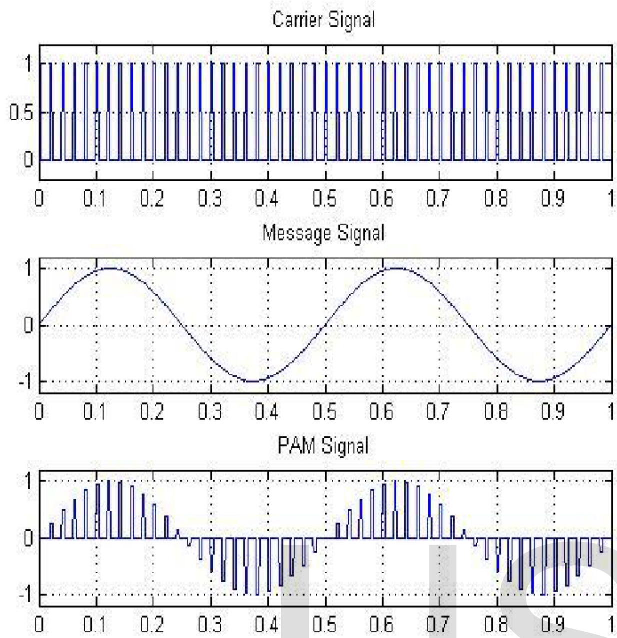

Figure 4: Simulated result of PAM 3

Carrier Frequency = 50
Message Frequency = 2
Sampling Frequency = 2000

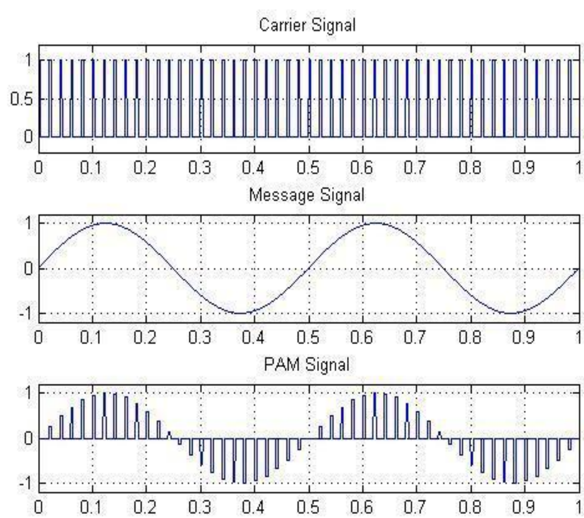

Figure 5: Simulated result of PAM 4

Carrier Frequency = 100
Message Frequency = 2
Sampling Frequency = 1000

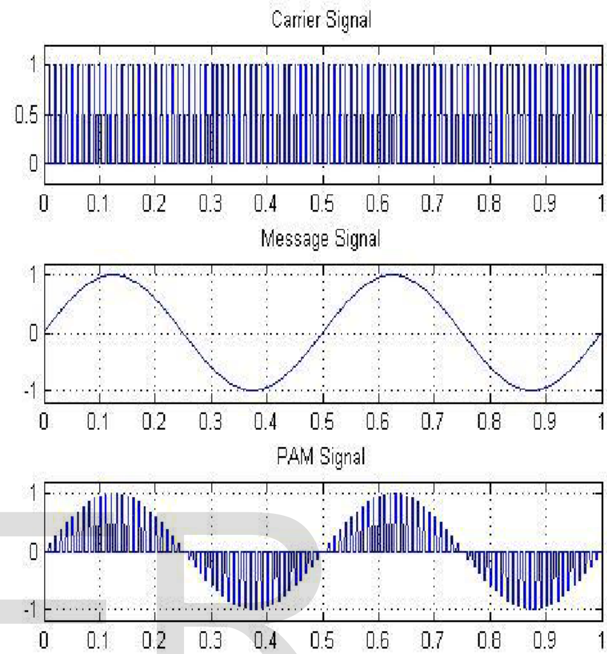

Figure 6: Simulated result of PAM 5

4.2 PPM Simulation Result

Here,
Carrier Frequency = 20
Message Frequency = 2
Sampling Frequency = 1000

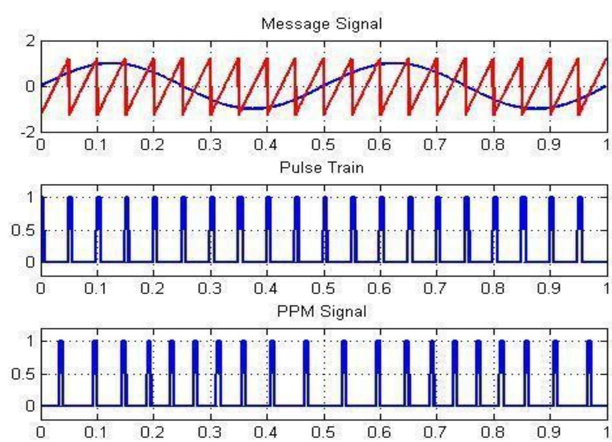

Figure 7: Simulated result of PPM 1

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Carrier Frequency = 20
Message Frequency = 2
Sampling Frequency = 2000

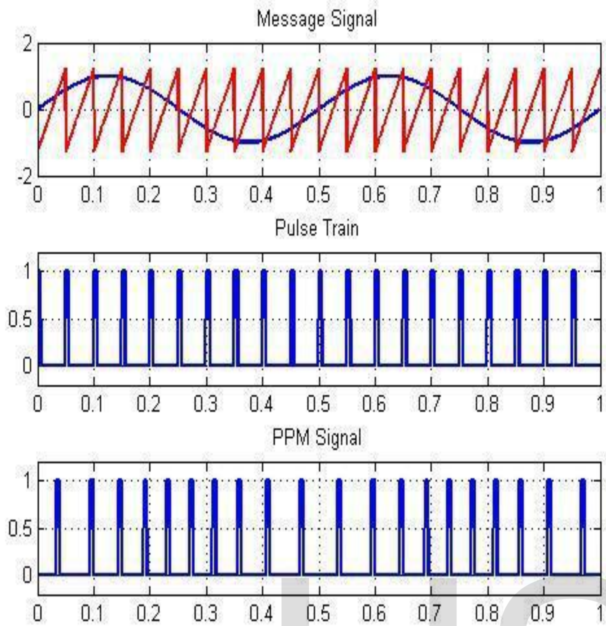

Figure 8: Simulated result of PPM 2

Carrier Frequency = 50
Message Frequency = 2
Sampling Frequency = 1000

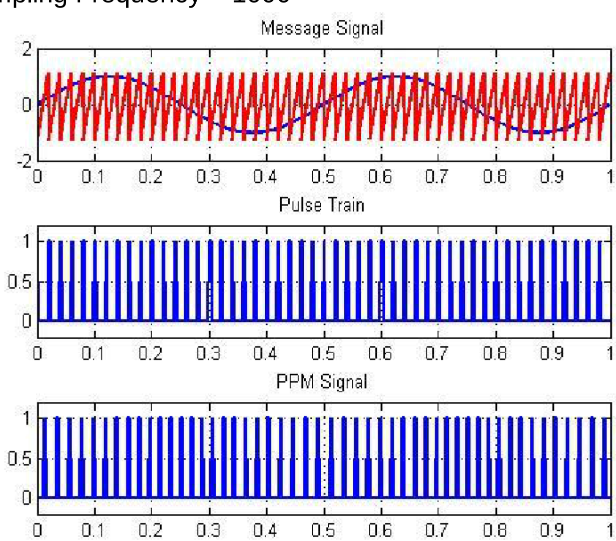

Figure 9: Simulated result of PPM 3

Carrier Frequency = 50
Message Frequency = 2
Sampling Frequency = 2000

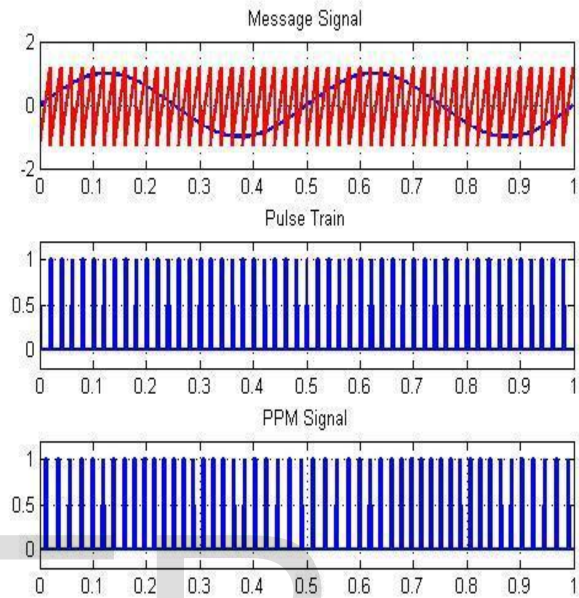

Figure 10: Simulated result of PPM 4

Carrier Frequency = 100
Message Frequency = 2
Sampling Frequency = 1000

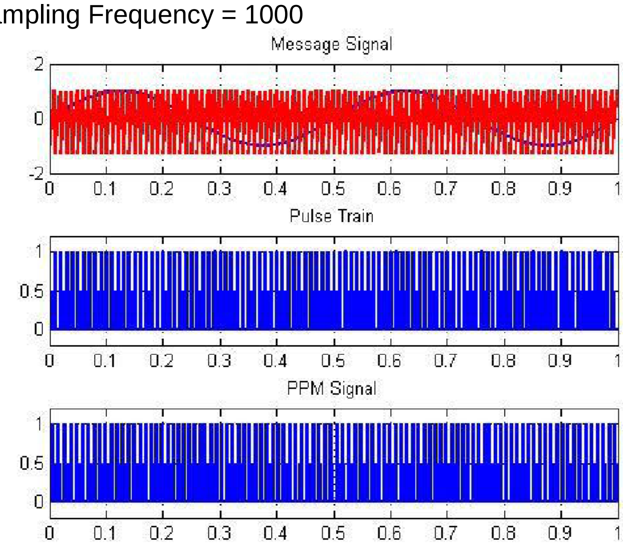

Figure 11: Simulated result of PPM 5

International Journal of Scientific & Engineering Research Volume 10, Issue 7, July-2019
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5 Analysis of Simulation Result

I. In PAM, Information contained in Amplitude Variations but in PPM, Position variations.
II. In PAM, required low bandwidth but PPM, required high.
III. In PAM, Transmitted power varies with the amplitude of pulses but in PPM, it remains constant.
IV. Synchronizing pulses is needed for PPM but PAM, not needed.
V. Both generations of detection are complex.
VI. In PAM and PPM waveforms of output signals are rectangular.

6 Findings

PAM

The useful signal to be transmitted is analogical; it is sampled in accordance with the theorem of Shannon. Nyquist-Shannon stated that **"The minimum sampling frequency of a signal that it will not distort its underlying information, should be double the frequency of its highest frequency component."** According to this theorem, the sampling period must be higher or equal of two times the period of the (useful) signal. The carrier signal is digital and is from a clock. When applying both signals (useful and carrier) at the inputs of the modulator, we obtain at its output the modulated signal (PAM). The width and the position of this signal are constant while its amplitude is directly proportional to the instantaneous amplitude of the useful signal.

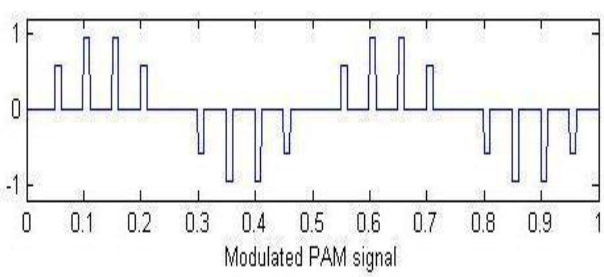

Figure 12: Modulated PAM Signal

In this paper observe that simulation starts late and that the exit is not in conformity with the PAM signal. The pulses are broad, the amplitude of the modulated signal changes with that of the input signal.

PPM

The PPM modulation consists in the sampling of modulating the signal, with each rising time of the clock, the modulated signal is a pulses train. Each pulse is delayed, compared to the clock, according to the amplitude of the modulating signal.

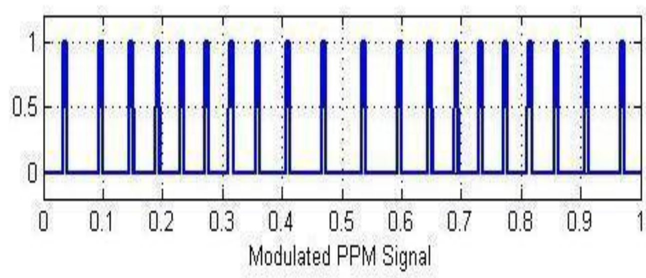

Figure 13: Modulated PPM Signal

The pulses duration is constant and is fixed by the monostable one. The pulses amplitude and width are holding constant in this system, whereas the position of each pulse, compared to the position of a reference pulse, is modified by the instantaneous sampled value. The PPM modulated signal can be obtained by differentiating PWM modulated signal to produce narrow pulses (PPM).

7 Future Work

We work on PAM and PPM. This thesis is not enough for understanding PAM and PPM. In the future, we will project to build the circuit on this thesis and compare the results. In the future, we can also work on PWM, PAPM and other modulation systems in different applications.

8 Conclusion

By the analysis of the same frequency, sampling and duty cycle, this paper obtains at its output the modulated signal (PAM). The width and the position of this signal are constant while its amplitude is directly proportional to the instantaneous amplitude of the useful signal. And also observe that simulation starts late and that the exit is not in conformity with the PAM signal. In PPM simulated output signal, the duration is constant and is fixed by the monostable one. In this system, the amplitude and width are holding constant, whereas the position of each pulse, compared to the position of a reference pulse, is modified by the instantaneous sampled value. In PPM and PAM has some difference and similarities. But If the PAM has not existed then PPM is not possible. If the pulse needs to transmit then the modulation is needed. For the long transmission, we can use PPM. For Short transmission, we can use PAM. The main Disadvantage of PAM is it varies with amplitude, so distortion can be added easily. We can conclude the PPM is better compared to PAM for modulation.

International Journal of Scientific & Engineering Research Volume 10, Issue 7, July-2019
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