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Manchester Coding and Decoding Generation Theortical and Expermental Design

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Abstract

This paper presents the implement and design of a line code Manchester coding and decoding theoretical and experimental designed system the experimental design was demonstrated in simulation using optics 7 , to observe the system performance with the present RZ & NRS line codes the main issue is to mixing RZ RNZ pulse coding in the XNOR gate ,so that the output of XNOR is the coding Manchester ,then mixing the coding Manchester with another RZ pulse generator in the another XNOR gate to obtain in the output Manchester decoding channel this is the procedure of our work.

Keywords: XNOR; RZ; NRZ; optisys 7 and clock Bit rate.

1. Introduction

A simple way was used in optical Communication set to mutate from Electrical to optical Binary Input Electrical Bit “1” was associated with a higher optical while bit “O” was associated to a lower optical intensity. Two styles are included in this modulation set: Non- return-to- zero (NRZ) and Return-to- zero (RZ) NRZ is the oldest and easier modulation style and obtain by switching a laser source between ON or OFF RZ term a line code applied in telecommunications signals in which the signal drops to zero between each pulse. It is occurred even if a number of consecutive “0” or “1” happens in the signal, it is self- clocking It's one implies a separate clock does not requirement to be sent alongside the signal but affords from using twice the bandwidth achieving the same data- rate contrast to non- return-to- zero style. Though return -to-zero (RZ) includes a saving for synchronization, a DC component still resulting in ‘baseline wander” through long strings of “o” or “1” bits, such as the line code non-return- to-zero The (NRZ) and (RZ) data signals show its style in figure 1 a&b respectively [1].

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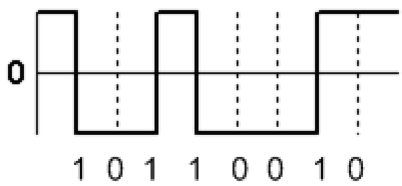
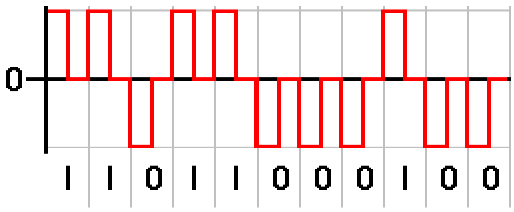
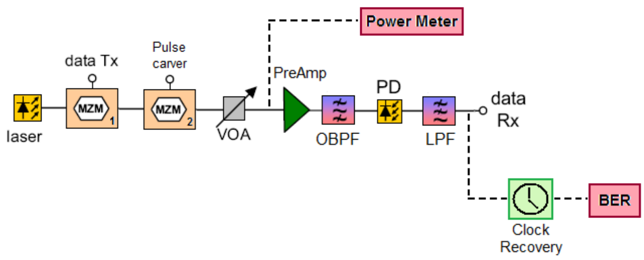




(a) NRZ No return-to-zero (b) RZ Return-to-zero

Figure 1: a) NRZ **Figure 2:** b) RZ data signal format

In this study, we demonstrate all optical style conversion between (RZ) and (NRZ) used a Mach -zehnder form interferometer wavelength converter. It is can be done modulating the output of the laser employing a MZM. In a situation of OOK the modulator is biased at 50% transmission and drive is from maximum to minimum transmission as show in Fig [2]. The construction of RZ –OOK is explain in fig [3]. Used the two diagrams to establish its simulation A wide use of these two data styles found although the RZ data style need twice the NRZ transmission bandwidth, it is quite helpful in application [2].



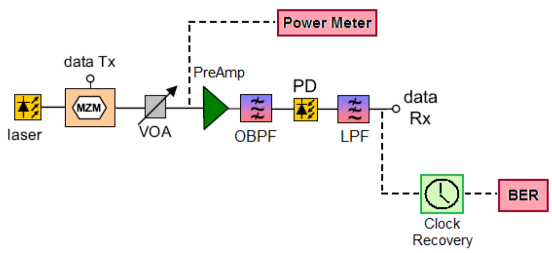


Figure 3: NRZ-OOK structure **Figure 4:** RZ- OOK structure

2. Idea of channel coding

Digital Line Coding is a coding system selection to allow transmission to occur in a communications system. The selection code or pattern of voltage applied to binary digits represented on a transmission medium is called line encoding. At telecommunication types, one type of line code is a bipolar encoding, where used two nonzero values, thus it three values are +, -, and zero That a signal is a duo binary signal called A line encoding is polar, unipolar and bipolar.

The channel coding core is based on two rules: information redundancy introduction and averaging the noise influence. Information redundancy introduction is sense by linking an additional symbol sequence to the information block appearing a given message the selection of sequence is done in a way that the transmitted message easily could be distinguished from other messages that could be transmitted potentially. The symbol sequences represented a message in such a way a very unlikely is that channel perturbations deform so number of symbols is high in the sequence that these erroneous symbols would destroy the possibility of a unique association of the received symbol sequence with the transmitted message The noise averaging effect, in turn, is done by association of the redundant symbols with a few different information symbols representing a given message.

Set the length of the binary block n = 5 So there are 25 = 32 possible binary sequences of length 5 Of these sequences 2k = 22 = 4 code sequences was select So, related each code sequence to one of four messages or, equivalently, to a special combination of k = 2 binary messages. Set the sequence of selected code have the form:

00000, 00111, 11100,1 1011

The number of positions is compare in which any pair of sequences differs, so that the minimum Hamming distance is between dmin = 3 So, if the decision upon made by the receiver of transmitted sequence is correct, the received sequence can vary from the transmitted one in at most t = _(3 − 1)/ 2_ = 1 position.

Consequently, the association of the received 5-bit sequence used in error correction (out of 32 sequences, 28 are incorrect) with the code sequence that is the closest in the Hamming distance sense.

All possible 5-bit sequences were appearing in table 2 1 in an ordered manner It is seen that each column leader is a code sequence. Binary sequences that vary from a given code sequence in one position are set below this sequence in the same column, so their Hamming distance does not exceed t from the column leader There are blocks for which the Hamming distance under those sequences from the column leader is d = 2 Unfortunately, several are equidistant of those sequences from two different code sequences, e g the sequence 10101 in two positions differ from the code sequence 00111 located in the same column and the code sequence 11011 in the next column.

The sequences existing 100 Introduction to Digital Communication Systems.

Table 1: The binary sequences assignment to the codeword

Codeword's	00000	11100	00111	11011
Correctables equences	10000	01100	10111	01011
($d = 1$)	01000	10100	01111	10011
	00100	11000	00011	11111
	00010	11110	00101	11001
	00001	11101	00110	11010
Uncorrectable sequences	10001	01101	10110	01010
($d = 2$)	10010	01110	10101	01001

2.1. Manchester Encoding

Manchester encoding (first published in 1949) technique is a synchronies clock encoding used by the physical layer to encode the clock and a synchronous data bit stream. At this mechanism, the transmitted of an actual binary data be over the cable are not sent as a sequence of logic 1's and 0's (recognized technically as Non-Return to Zero (NRZ)) In state, the translated of bits into a slightly different style that has a number of feature over using straight binary encoding i e(NRZ) [4].

At this encoding shown, a logic 0 is specific by a 0 to 1 transition at the middle of the bit and a logic 1 is specific by a 1 to 0 transition at the middle of the bit Note that signal transitions do not always take place at the ‘bit boundaries’ (the division between one bit and another), but always there is a transition at the middle of each bit . The summary of Manchester encoding rules are shown below:

Original Data	Amount Sent
Logic 0	0 to 1 (upward transition at bit middle)
Logic 1	1 to 0 (downward transition at bit middle)

We note that in some cases the encoding reversed, with 0 being appear as a 0 to 1 transition for many years the two definitions have co-existed. The method in which a Logic 0 is sent as 0 to 1 transition describe in The Ethernet Blue-Book and IEEE standards (10 Mbps), and a Logic 1 as a one to zero transition (where a zero is appear by a less negative voltage on the cable) observe that because many physical layers use an inverting line driver to switch the binary digits into an electrical signal, by the encoder the signal on the wire is the exact opposite of that output Differential physical layer transmission, (e g 10BT) does not know this inversion[5] The below graph shows a typical Manchester encoded signal with the corresponding binary performance of the data (1,1,0,1,0,0) being sent .

Fig 4 The Manchester encoded waveform bit stream carrying the sequence of bits 110100 See that signal transitions do not always happen at the 'bit boundaries' (the division between one bit and another), but always at the middle of each bit there is a transition Where each bit is encoded by a positive 90 degree phase transition, or a negative 90 degree phase transition the encoding may be alternatively viewed as a phase encoding Therefore The Manchester code is sometimes known as a Biphasic Code .

A signal contains frequent level transitions in Manchester encoded which allow the receiver to evolve the clock signal using a Digital Phase Locked Loop (DPLL) and decode the value correctly and timing of each bit Using a DPLL to allow reliable operation, the transmitted bit stream should contain a high density of bitt transitions Allowing the receiving DPLL to correctly evolve the clock signal by Manchester encoding[6].

Approximately twice the bandwidth of the original signal (20 MHz) the bi-phase Manchester encoding can consume This is the forfeit for introducing frequent transitions The signal spectrum lies for a 10Mbps LAN between the 5 and 20 MHz The physical layer of an Ethernet LAN used by Manchester encoding, where the additional bandwidth is not a significant matter for coaxial cable transmission, for 100 Mbps transmission the limited bandwidth of CAT5e cable necessitated a more efficient encoding method using a 4b/5b MLT code

Three signal levels use (instead of the two levels used in Manchester encoding) and therefore a 100 Mbps signal allows to take only 31 MHz of bandwidth To provide even more efficient use of the limited cable bandwidth, sending 1 Gbps within 100 MHz of bandwidth, a Gigabit Ethernet utilizes five levels and 8b/10b encoding The Manchester code is quite public It is a self-clocking code known because a transition is always during the bit interval Consequently, there is no clocking problems by a long strings of zeros or ones .

2.2. Manchester Encoding example

The modality of bits " 0 1 1 1 1 0 0 1 " encodes to " 01 10 10 10 10 01 01 10" Another an example is the modality " 1 0 1 0 1 etc" more curious which encodes to "10 01 10 01 10 " which also could be viewed as "1 00 11 00 11 0 ". Thus the preamble sequence encodes to a 5MHz square wave! (i e , One half cycle in each 0 1 microsecond bit period) for a 10 Mbps Ethernet LAN.

2.3. The Manchester Coding working

Manchester code follows an algorithm to encode data like all other coding methods the algorithm is going like: The represented NOT by logic 1 or 0 of data, but with line transitions. A transition from HIGH to LOW is represented a logic 0, and a transition from LOW to HIGH is represented a logic 1 In below there is very simple 5-bits example:

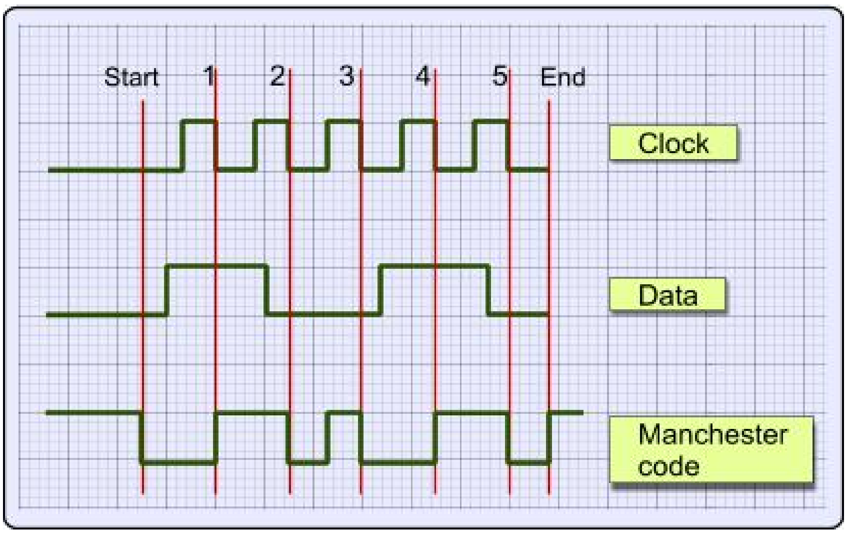


Figure 5: Manchester codes generation

The data which used to encode ist he binary number 10010, from left to right on every falling edge of the clock the coding happen. It's has a LOW to HIGH transition, on the first falling edge of the clock, the data is HIGH The code has a HIGH to LOW transition because the data is LOW, on the second falling edge of he clock the same algorithm is utilized for the rest of the signal.[7] For the speed of traveling signal in over the coaxial cable is equal to 0 77 three times speed of light i e 45 0 77 x 3 x $1o^{8,}$ while in the twisted cable the speed will be slowly and equal to 1 77 x $10^{8.}$

3. Experimental work and results

The opt system 7 results was achieved to have a performance of (RZ), and (NRZ) Figure 5 referring to the block diagram of the experimental work done by the simulation optisys, this diagram have two bitrates every one of them connected to RZ &NRZ line code to be mixed in the XNOR gate to generate Manchester encoding ,while in the another side the Manchester encoding will be mixed with one RZ in another XNOR to generate Manchester decoding .

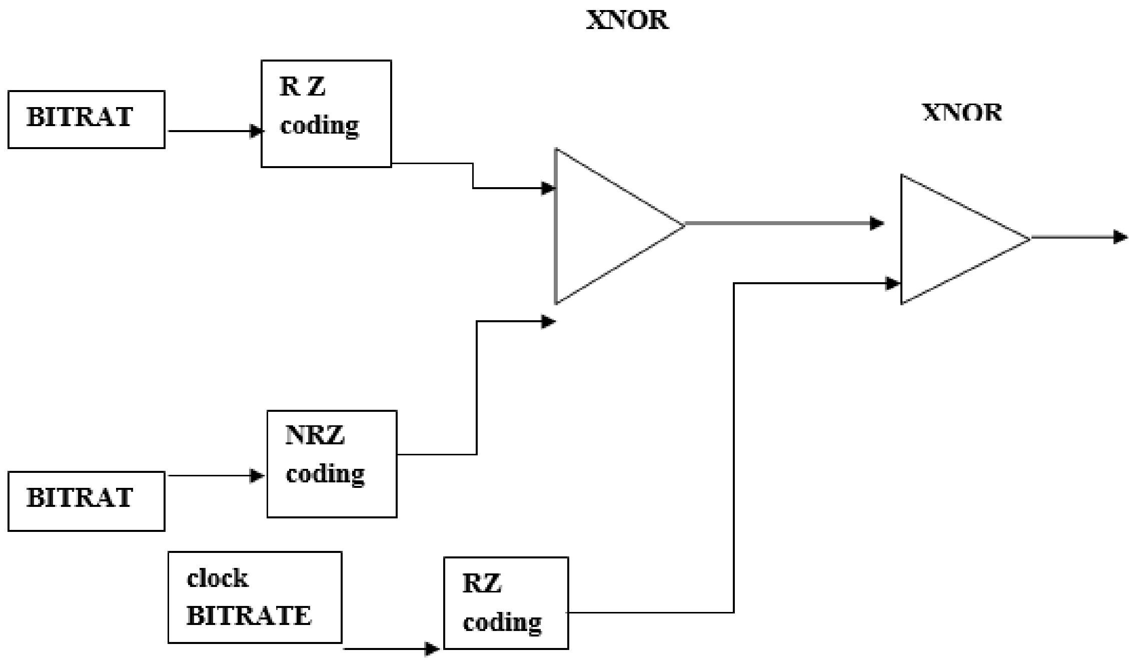
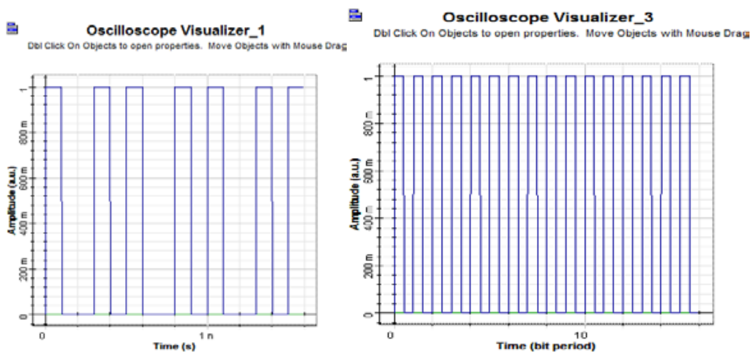


Figure 6: Block diagram designing of the experimental work



RZ line code **NRZ line code**

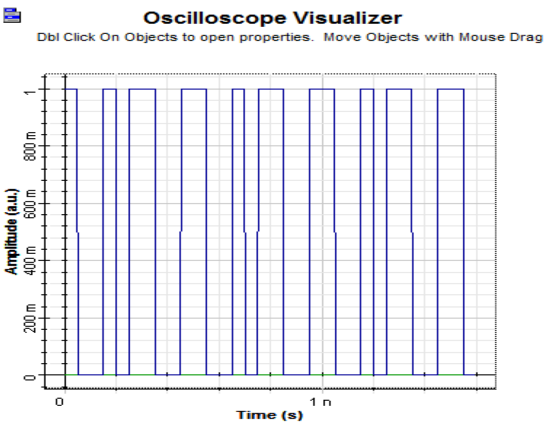
Figure 7: mixing RZ & NRZ line codes in the transmitter channel

From figure 6 we can see that the NRZ line code with low bandwidth will be mixed with another RZ line code, lower band width, the same in the transmitter channel.

A " 0 " is represented a transmitted by no pulse.

A " 1" is represented a transmitted by a pulse f(t) or - f(t), based on whether the previous "1" was transmitted by - f(t) or f(t) .

For more illustration we put two oscilloscopes to explain the wave forms of the generations of Manchester encoding and decoding, as illustrated in figures 7 & 9 below in another word we can explain the generating of Manchester code by mixing the data information with time sequence then the results is the Manchester code, with high bandwidth As shown in figure 5 Manchester is also known as split - phase signal. The signal amplitude of first 1/2-bit time is positive voltage level, when the data bit is '1' and the other 1/2-bit time is negative voltage level the signal amplitude first 1/2-bit time is negative voltage level, when the data bit is '0' and the other 1/2-bit voltage level is positive.



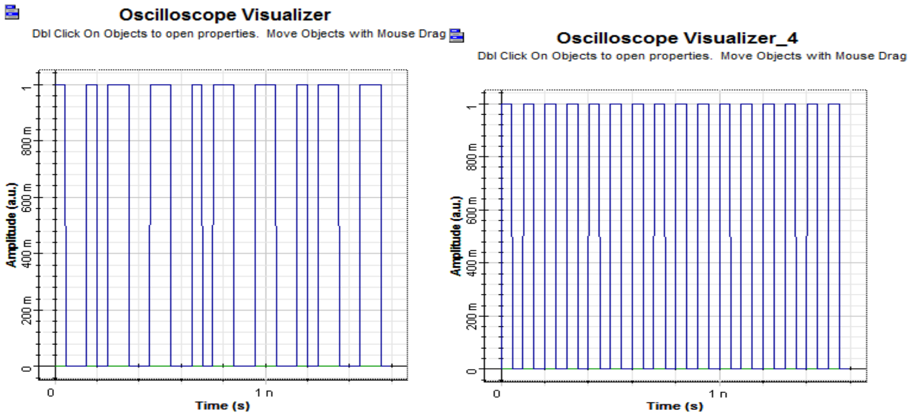
Manchester coding

Figure 8: Manchester line code as encoding channel

Figure 7 illustrate the Manchester line code as encoding in the transmitter channel ,which is generating from mixing the RZ and NRZ pulse generators at the time equal to 1nm from the transmitter channel sending to the receiver channel to be mixed with another RZ line code in another XNOR gate to perform a Manchester decoding this meaning that we can achieve rise bandwidth and perfect clock recovery system, also no Dc strain this is a very useful in our design of a transceiver system .

Figure 8 referring to the receiver channel it me to generate Manchester decoding we must entering two signals' one is the Manchester encoding and the second is from RZ pulse generator mixing them to gather to an XNOR gate to generate Manchester decoding signal.

Finally, we can see the results of this work from figure 8, generation of Manchester line code form the change will appearing in the bandwidth which we needed, as from this figure we can see the wave form of Manchester decoding with high bandwidth is more useful from another line codes to be implement in the digital communication system.



RZ line code **Manchester coding**

Figure 9: Mixing two codes in the XNOR gate to perform Manchester decoding

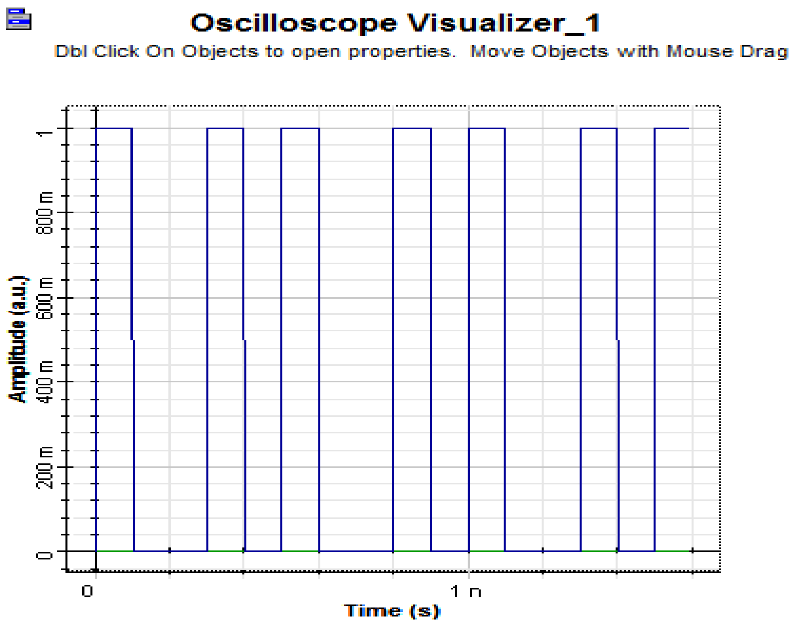


Figure 10: Manchester decoding

4. Conclusion

Manchester code is one of the several types of line codes, it's generation is very simple depending to the comparing between clock and data signals, the memory is the advantage of this type of encode signal, So the desired bandwidth is higher than another code signal. This make it's a suitable utilized to different type of network such as Ethernet.

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