Digital signal formatting

Introduction : Digital Signal formatting is the process of transforming information from one format into another.. This is often used in many digital devices and for communication processes. A digital system is a data technology that uses discrete (discontinuous) values. By contrast, non-digital (or analog) systems use a continuous range of values to represent information. Although digital representations are discrete, the information represented can be either discrete, such as numbers, letters or icons, or continuous, such as sounds, images, and other measurements of continuous systems.

Now we discuss about in the detail signal format in digital systems.

Non-return-to-zero format:

One of the simplest ways to transmit digital data is by having a separate clock and data line. In this approach, a clock signal of constant frequency is synchronised with its corresponding data. Depending upon the preference of the designer, the data is either latched on the rising or falling edge of the clock.

For a given data signalling rate that is the bit rate, the NRZ code have requires only one half of the band-width required by the ing. When we used to show data in an asynchronous communication scheme, the absence of a neutral state requires other methods for data backup to replace method used for error detection when using synchronization data when a separate clk signal is available here.

NRZ Level itself is not a synchronous system but besides encoding that can be used in either a synchronous or asynchronous transmission environment that is with or with out an external clock signal involved in it. Because of that it is not strictly important to discuss how the NRZ-Level encoding act as on a clock edge and during a clock cycle since all transitions happen in the given amount of time represents the actual implied integral clock cycle. The real question is that of sampling the high/low state be received correctly provided the transmission line has stabilizes for that bit when the physical line level is sampled at the receiving end.

However may be it is handy to see NRZ transitions as happening on the trailing clock edge in order to compare NRZ-Level to other encode methods such the given Manchester coding which require clock edge information and to see the difference between the NRZ Mark and NRZ Inverted signals.

Uni-polar Non-Return-to-Zero Level:

One is represents by the one physical level Zero is represented by an other levels which is a + voltage level.

In the clock language the 1 transitions and remain highest on the trailing clock edge of the previous bit and " 0" transitions or remains low on the trailing clock edge of the previous bit, or may be just the opposite. This allows for long series without change, which makes synchronization difficult. There is only the solutions are to not send the bytes or data without uses of transitions.

The fig show a line represents the physical zero under the biased logical zero shows the less usually case of " 1" being a higher voltage level.

Non Return-to-Zero Space:

One is represents by no change in physical level.” 0″ is represents by the change in physical stage. In clock language the level transitions on the trailing clock peak point of previous bit to represent 0.

That change on zero is used by High Level Data Link and USB. They avoid long intervals of time of no transition whether there may be, when the data contains long sequence of 1 bit by using zero bit insertion. HDLC transmitters insert a zero bit after five contiguous one bits except when transmitting the frame. USB transmitters insert a zero bit after six continuously 1 bits. The receiver at the far end use the each transition both from zero bits in the data and these extra 0 bits for maintain clock synchronize. The receiver rather than ignore these non “ zero” bits.

Non-Return-to-Zero Inverted (NRZI)

NRZI-transition occurs for a zero

Non return to zero, inverted is technique of detect a binary to a analog signal for transmission over some transmitter medium. There are 2 level NRZI signal has a transition at a clock boundary if there is the bit being sent is a logical one and does’nt having a transition if the bit being transmit is a logical zero.

“ 1” is represented by a transition of the physical level. “ 0” has no transition.

Also the NRZI may be take the opposite convention in Universal Serial Bus signalling, when in the Mode one transition when signalling zero and steady level when signalling one. The transition occurs upon the leading edge of the clock for the given bit. This distinguishes NRZI from NRZ mark. Even thoughr, even NRZI can have long series of zeros (ones if transitioning on “ o”), so clock recovery can be difficult unless some form of run length limited coding is used on top. Magnetic disk and tape generally uses fixed rate RLL codes while USB uses bit stuffing, which is more efficient, but results in a variable data rate it takes lower levelto send a long string of 1 bits over USB than it does to send a long string of 0 bits.

Return-to-zero

The binary signal is encoded using rectangular pulse amplitude modulation with polar return-to-zero code

Return-to-zero (RZ) describes a line code used in telecommunications signals in which the signal drops (returns) to zero between each pulse. Returns to zero modulation formats are becoming increasingly popular for long-haul optical fiber transmission systems at bit rates of 10 Gb/s and above. Previously, the benefits of RZ formats were often overlooked, because they require larger bandwidth than non-return-to-zero (NRZ) formats, and their generation typically requires two cascaded Mach-Zehnder (MZ) modulators. In recent years, it has been shown that RZ can have superior performance over NRZ in certain regimes where chromatic dispersion and fiber nonlinearities are present [2]-[4], as the RZ pulse may exhibit “ soliton-like” properties. In addition, RZ has greater tolerance to polarization-mode dispersion than NRZ Recent research has compared the performance of RZ with different modulation techniques, including binary ON-OFF keying (OOK) and binary differential phase-shift keying (2-DPSK) RZ pulses are frequently generated by driving an MZ modulator by a sinusoidal drive waveform; we assume throughout this paper that RZ pulses are generated in this manner. We define the pulse duty cycle as TFWHM/TS, where TFWHM is the pulsewidth (full-width at half-maximum intensity), and TS is the symbol duration. Depending on the drive waveform amplitude and bias, RZ pulses can have duty cycles of 33%, 50%, and 67%. In particular, 67% RZ is often referred to as carrier-suppressed RZ (CSRZ).

Biphase mark code:

The biphase mark code is a type of encoding format for binary data streams. When a binary data stream is sent without modification via a channel, there can be long series of logical ones or zeros without any transitions which makes clock recovery and synchronization difficult. Streams encoded in NRZ are affected by the same problem. Using biphase mark code makes synchronization easier by ensuring that there is at least one transition on the channel between every data bit; in this way it behaves much like the Manchester code scheme.

Every bit of the original data is represented as two logical states which, together, form a bit. Every logical 1 in the input is represented as two different bits (10 or 01) in the output. The input logical 0 is represented as two equal bits (00 or 11) in the output. Every logical level at the start of a cell is inversion of the level at the end of the previous cell. In BMC output the logical 1 and 0 are represented with the same voltage amplitude but opposite polarities, as shown in the following image:

These coding provides a better results there is a change in the polarity at the minimum every two bits. That is not need to know the polarity of the sent signal since the information is not kept in the actual values of the voltage but in their change: in other words it does not matter whether a logical 1 or 0 is received. At last BMC code signal has 0 average DC voltage, therefore decreasing the necessary sending power and also reduces the electromagnetic disturbance generated by the transmission line. All these + aspects are achieved at the expense of doubling clock frequency.

Manchester encoding:

Manchester encoding offers distinct advantages over other digital encoding schemes. It has become a popular standard for low-cost radio frequency communication of digital data.

In reality, Manchester encoding was the result of research done at the University of Manchester into phase modulation techniques used for reading and writing digital data onto a magnetic storage device. Since that time, Manchester encoding has gained wide acceptance as the modulation scheme for low-cost radio-frequency transmission of digital data. One of the most significant characteristics of Manchester encoding is its unique way of representing digital data. Rather than representing data

Construction of Manchester-encoded data: Manchester encoding is very easy to construct. You simply combine the serial bits to be encoded with the clock running

at the bit-boundary rate When you compare the Manchester-encoded output with the bit stream, you’ll see the same waveform.

Decoding Manchester-encoded Data Decoding Manchester-encoded data is as easy as encoding it. You simply perform an exclusive-OR of the Manchester encoded signal with a logical “ 1” at the bit-boundary sample points, as shown in Fig.

Differential Manchester encoding:

A more esoteric version of Manchester encoding is a scheme called Differential Manchester encoding (DME). Think of it as Manchester encoding on steroids. DME is a more efficient encoding scheme because it requires less bandwidth than standard Manchester encoding. The overhead of transmitting a data stream using DME is less because it doesn’t require a preamble, which is used by the DPLL to lock onto the clock frequency. Because of this, DME can be found in networks, such as fast Ethernet over copper twisted-pair wiring. DME differs from standard Manchester encoding in one simple way: Manchester encoding represents binary data based on a positive or negative edge transition at each bit boundary. DME represents data by the presence or absence of a transition between two bit boundaries. Simply stated, if a transition occurs between a bit boundary, it’s represented as a binary 0. An absence of a transition signifies a binary 1. As a complement to this reintroduction to the basics of Manchester encoding for lowbit serial network applications, a second article is available online at Embedded. com. The article will leverage from the theory presented here and offer a practical, real-world example that illustrates the simplicity of implementing Manchester encoding into a real embedded design.

AMI (Alternate Mark Inversion) encode format :

AMI (Alternate Mark Inversion) is a synchronous clock encoding technique which uses bipolar pulses to represent logical 1 values. It is therefore a three level system. A logical 0 is represented by no symbol, and a logical 1 by pulses of alternating polarity. The alternating coding prevents the build-up of a d. c. voltage level down the cable. This is considered an advantage since the cable may be used to carry a small d. c. current to power intermediate equipment such as line repeaters.

AMI coding was used extensively in first generation PCM networks, but suffers the drawback that a long run of 0’s produces no transitions in the data stream (and therefore does not contain sufficient transitions to guarantee lock of a DPLL). Successful transmission therefore relies on the user not wishing to send long runs of 0’s and this type of encoding is not therefore transparent to the sequence of bits being sent.

The HDB3 encoding scheme is one of many which have been developed to provide regular transitions irrespective of the pattern of data being carried.

Example of AMI encoding

The pattern of bits ” 1 0 0 0 0 1 1 0 ” encodes to ” + 0 0 0 0 – + ” (the corresponding encoding using HDB3 is ” + 0 0 0 + – + “).

High Density Bipolar Order 3 Encoding:

The HDB3 code is a bipolar signaling technique (i. e. relies on the transmission of both positive and negative pulses). It is based on Alternate Mark Inversion (AMI), but extends this by inserting violation codes whenever there is a run of 4 or more 0's. This and similar (more complex) codes have replaced AMI in modern distribution networks.

Conclusion : The Digital signal formats are the techniques by which we uses the digital data in different formats for uses of different purposes. It is mostly used as wide applications in communication fields. Although digital representations are discrete, the information represented can be either discrete, such as numbers, letters or icons, or continuous, such as sounds, images, and other measurements of continuous systems by using these different encoding or digital formats techniques.

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Books:

1. Computer Networks and data communication by Frauzan.
2. Computer networks by J. s katre (tech-max publisher)
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