

Experiment-4

Aim: To study Line Codes & Implementing them in Matlab/Octave.

Software Used: Octave.

Theory: Line coding is the process of converting digital data to digital signals. Line coding converts a sequence of bits to a digital signal. At the sender, digital data are encoded into a digital signal; at the receiver, the digital data are recreated by decoding the digital signals.

Characteristics of Line Coding:

1. Signal element vs Data Element: A data element is the smallest entity that can represent a piece of info. In digital data comm, a signal element is shortest unit of a digital signal.
2. Data Rate versus Signal Rate: The data rate defines the number of data elements sent in 1s. The signal rate is the number of signal elements sent in 1s. The unit is Baud. The data rate is called bit rate.
3. Bandwidth: Digital signal that carries information is non-periodic. The bandwidth of a non-periodic signal is continuous with an infinite range. However, most digital signals we encounter in real life have a bandwidth with finite values. The effective bandwidth is finite.
4. Baseline Wander: In decoding the receiver calculates a running average of received signal power. This average is called baseline. A long string of 0s & 1s can cause drift in the baseline.
5. DC Component: When the voltage level in a digital signal is constant for a while, the spectrum contains very low frequencies.
6. Self Synchronization: To correctly interpret the signals received from the sender, the receiver's bit interval must correspond exactly to the sender's bit intervals. If the receiver clock is faster or slower, the bit intervals are not matched & the receiver might misinterpret the signal.

7. Built-in Error Detection :- It is desirable to have a built-in error detecting capability in the generated code to detect some of or all the errors that occurred during transmission. Some encoding schemes that we will

8. Immunity to Noise & Interference :-

9. Complexity :- A complex scheme is more costly to implement than a simple one.

Each line code has advantages & disadvantages :-

The unipolar NRZ line code has the advantage of using circuits that require only one power supply, but it has the disadvantage of requiring channels that are DC coupled, because the waveform has a non-zero DC value.

The polar NRZ line code does not require a DC coupled channel, provided that the data toggles between binary 1's & 0's often and that equal of 1's & 0's are sent. However, the circuitry that produces the polar NRZ signal requires a negative voltage power supply as well as the positive voltage power supply.

The Manchester NR line code has the advantage of always having 0 DC value, regardless of the data sequence, but it has twice the bandwidth of the unipolar NRZ or polar NRZ code because the pulses are half the width.