Text

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**Laboratory Report**

Spring 2024

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| Laboratory Number: | **5** |
| Laboratory Title: | **Baseband Transmission Through Dispersive Channel** |
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**Introduction:**

The purpose of this lab is to investigate the effects of utilizing two different kinds of encodings through dispersive channels. To do this, we must generate binary signals that utilize either Polar Non-Return to Zero (PNRZ) and Manchester encoding, put them through a filter that simulates a noisy dispersive channel, calculate an error rate, and then graphically inspect the eye diagrams.

**Procedure:**

Before Starting:

1. Define an amplitude based off your TUID and define some other parameters.

|  |
| --- |
| tuid = [9,1,6,0,2,7,2,0,7];  A = tuid(9) + 2; % amplitude in amps  rb = 500; % Bit rate  fs = 32\*1000; % Sampling frequency  Tb = 1/rb; % Bit interval  Ts = 1/fs; % Sampling interval  N = 30; % Number of bits to be transmitted |

Task 1/2:

1. Generate a binary signal
2. Use PNRZ to encode the signal
3. Use a filter to simulate passing the encoded signal through a noisy dispersion channel
4. Iterate through several SNRs and calculate the error
5. Plot the error rate as a function of the SNR
6. Plot the eye diagram of the signals at 0 dB SNR for distorted and distortion less

Task 3/4:

1. Repeat Task 1 & 2 for Manchester encoding
2. Plot the transmitted and received signals on the same plot to compare

**Results:**

Task 1:

|  |  |
| --- | --- |
| PRNZ | Manchester |
| A graph with blue lines  Description automatically generated | A graph of different colored lines  Description automatically generated |
| Distorted | Distorted |
| Distortionless | Distortionless |
|  | A graph of a graph showing a number of signals  Description automatically generated with medium confidence |
| A graph of different colored lines  Description automatically generated | |

**Descriptive Answers to Tasks:**

Task 1:

No questions

Task 2:

No questions

Task 3:

The eye diagram looks completely different, and this is due to the Manchester encoding being less effective at transmitting raw data due to the transmission of the clock in conjunction with a greater bit rate. It is definitely not the same as dispersive PNRZ coding because we would lose less information with PNRZ as noise doesn’t impact that style of coding as much as it impacts Manchester coding. The tradeoff is that we don’t get clock information from the signal when utilizing PNRZ, but since our target is to minimize error, this is irrelevant.

Task 4:

My overall observation is that Manchester encoding gathers more error due to its presence of a clock which makes it more susceptible to error caused by noise. If the overall goal of the encoding is to minimize error rate of value rates I would select PNRZ, but if we needed the clock rate of the signal being sent, I would select Manchester encoding.

**Conclusion:**

By comparing these two encoding techniques, we can see that PRNZ is much better for the application of keeping raw data over a noisy channel. This is due to the inherent nature of these two different types of encodings being meant for different applications. While PRNZ is better for this task Manchester would be better for timing related tasks where the clocking rate needs to be accounted for.