CIE 337 Project Two Report (Part II)

Encoder Program Using MATLAB® App Designer

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Overview

After the signal being sampled and quantized, encoding the signal using different *line codes* for more robustness against noise and interference is crucial for the transmission over a given channel. In this part of the project, a GUI-based program is built to encode an enter-by-the-user stream of bits/symbols by four different techniques, where the user is allowed to choose between **unipolar NRZ**, **polar RZ**, **Alternate Mark Inversion** (AMI) and **Manchester** signaling. Also, the user is allowed to enter **N** bits to be randomly generated, the bit duration T_b and the amplitude of the signal A. A plot of the encoded signal is displayed, in return.

The Program Layout Design

The initial program layout design shown in **Figure 1** has the following components:

- A drop-down component to allow the user to choose between random generation of bits or enter a stream of bits.
- A drop-down component that allows the user to choose between different line codes.
- A push button when clicked, it displays the random signal generated by the program and plot of the line-coded signal.
- An axes component for the plots to be drawn on.
- A label component to display the random signal generated by the program.

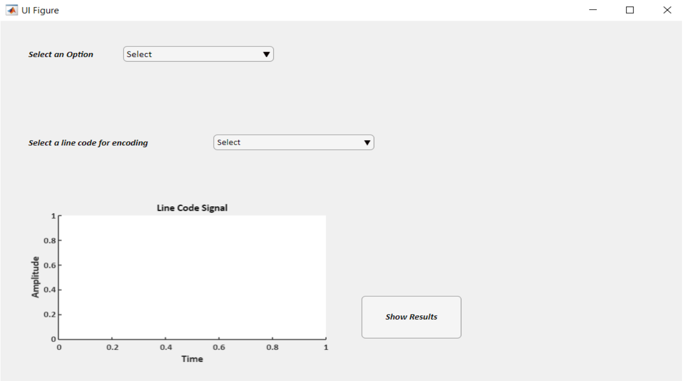


Figure 1: The initial Program Layout

How the Program works

When running the program, a window is prompted to the user asking to select between random generation by the program of bits **or** enter a stream of bits. Once the user selects random generation of the to-be-encoded signal, two entry fields appears, where the first asks the user to enter the number of bits to be generated, and the second asks the user to enter T_b and A, where a space to be placed in between them is a ***must***. Then, the user is allowed to choose a line code from four different options. After the user does all that is required, a button 'Show Results' is to be clicked to get a plot of the encoded signal and the randomly-generated signal in case of choosing to enter **N**. For the bit stream entry selection, two entry fields appears, where the first asks the user to enter a stream of bits, and the second asks the user to enter T_b and A, where a space to be placed in between each elements in both entry fields is a ***must***. The following step is the same as one mentioned.

The Results of the Test Input Signal

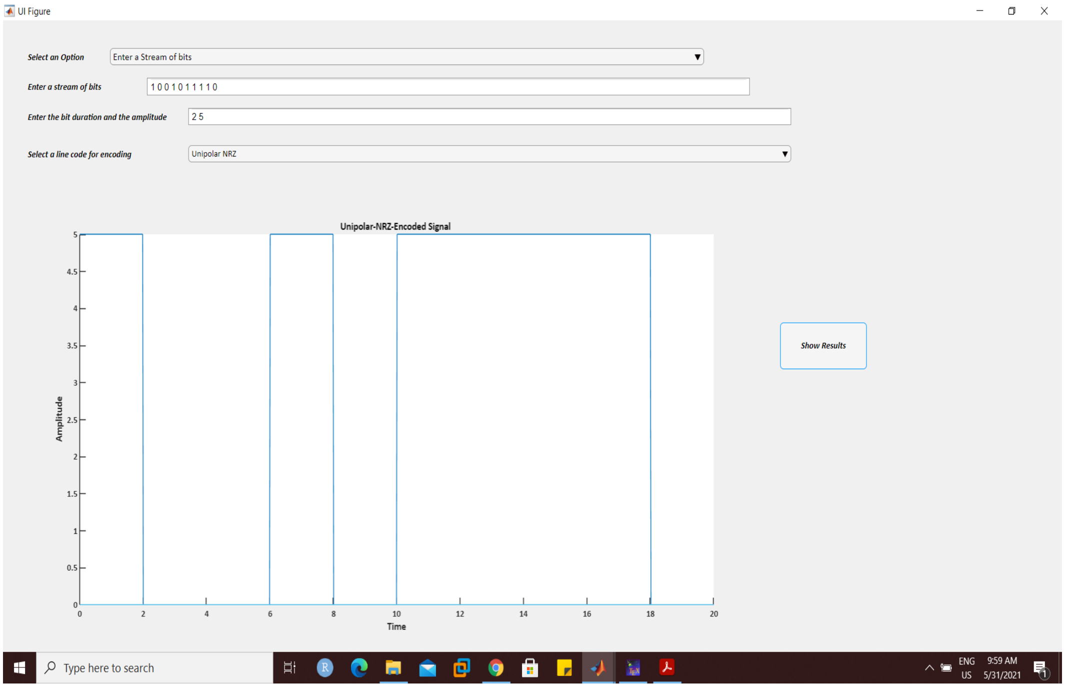
In this section, the results of testing the program with a randomly-generated test signal is shown. The signal is generated using a MATLAB® code, that is submitted with this report. The generated stream of bits has 10 bits of only 1's and 0's, where it is tested for the four line codes.

The Generated Signal

The generated signal that is to be tested is [1 0 0 1 0 1 1 1 1 0], where $T_b = 2$ unit time, and $A = 5$.

The Results of the Unipolar NRZ Case

The results of the Unipolar NRZ Case came as shown in **Figure 2**.



UI Figure

Select an Option: Enter a Stream of bits

Enter a stream of bits: 1 0 0 1 0 1 1 1 1 0

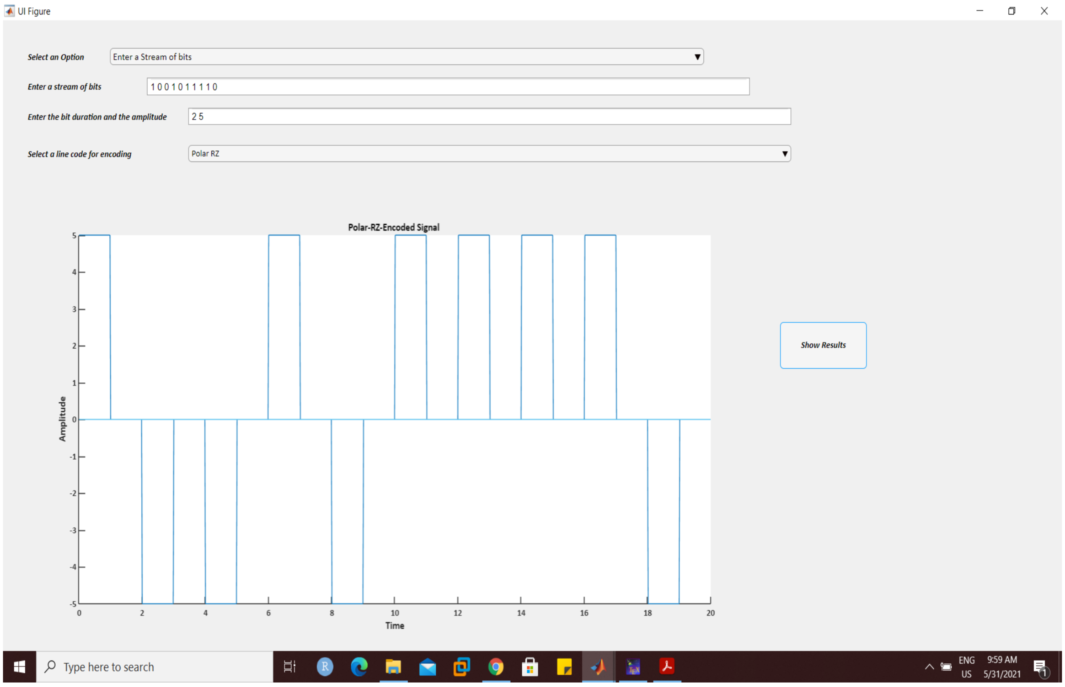
Enter the bit duration and the amplitude: 2 5

Select a line code for encoding: Unipolar NRZ

Figure 2: The Unipolar NRZ Case Plot

The Results of the Polar RZ Case

The results of the Polar NRZ Case came as shown in **Figure 3**.



Select an Option: Enter a Stream of bits

Enter a stream of bits: 1 0 0 1 0 1 1 1 1 0

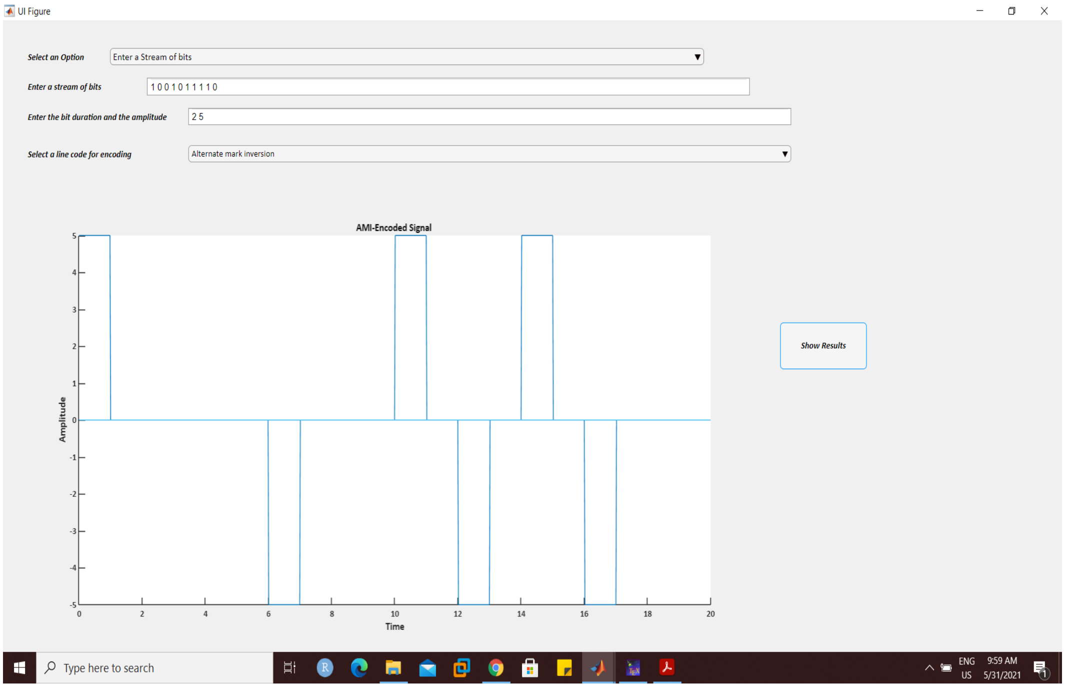
Enter the bit duration and the amplitude: 2 5

Select a line code for encoding: Polar RZ

Figure 3: The Polar RZ Case Plot

The Results of the AMI Case

The results of the AMI Case came as shown in **Figure 4**.



Select an Option: Enter a Stream of bits

Enter a stream of bits: 1 0 0 1 0 1 1 1 1 0

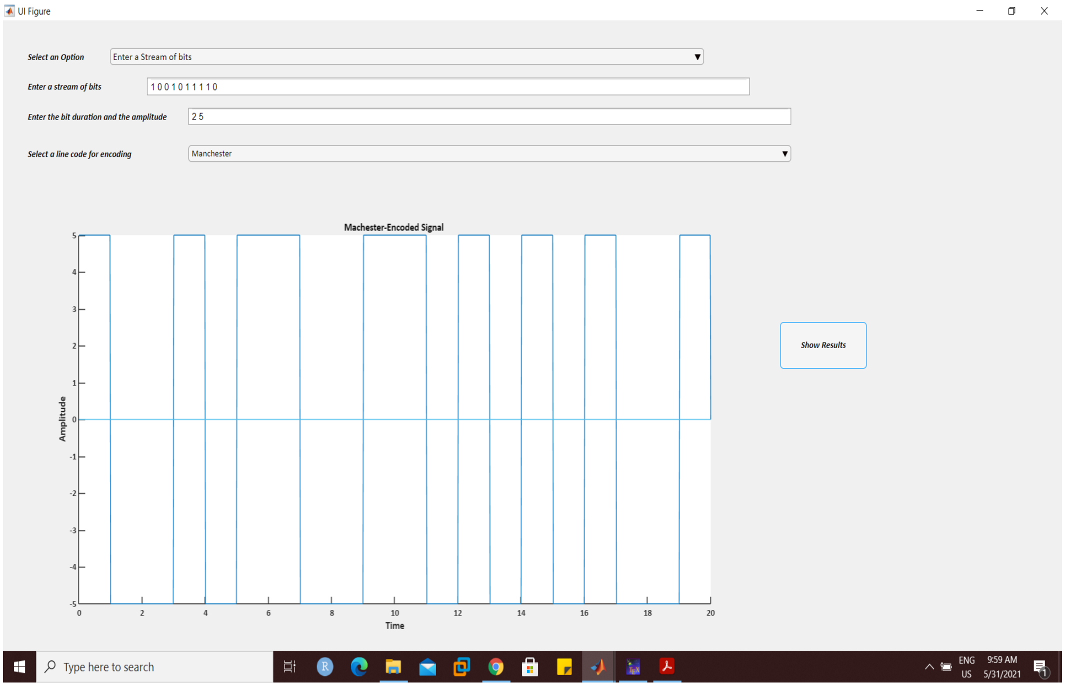
Enter the bit duration and the amplitude: 2 5

Select a line code for encoding: Alternate mark inversion

Figure 4: The AMI Case Plot

The Results of the Manchester Case

The results of the Manchester Case came as shown in **Figure 5**.



UI Figure

Select an Option: Enter a Stream of bits

Enter a stream of bits: 1 0 0 1 0 1 1 1 1 0

Enter the bit duration and the amplitude: 2 5

Select a line code for encoding: Manchester

Figure 5: The Manchester Case Plot