Lab-4

Aim: Line Codes

NRZ FAMILY:

1. NRZ-L unipolar
2. NRZ-L Polar
3. NRZ-M Unipolar
4. NRZ-M Polar
5. NRZ-S Unipolar
6. NRZ-S Polar
7. NRZ-AMI

RZ FAMILY:

1. RZ unipolar
2. RZ bipolar

MANCHESTER:

1. Bi -ϕ -L

1. NRZ-L unipolar

$$s(t) = \left\{ \begin{array}{ll} 1, & for\ 0 \rightarrow T_b if\ b[nT_b] = 1 \\ 0, & for\ 0 \rightarrow T_b if\ b[nT_b] = 0 \end{array} \right\}$$

2. NRZ-L Polar

$$s(t) = \left\{ \begin{array}{ll} 1, & for\ 0 \rightarrow T_b if\ b[nT_b] = 1 \\ -1, & for\ 0 \rightarrow T_b if\ b[nT_b] = 0 \end{array} \right\}$$

3. NRZ-M Unipolar

1. Mark based differential encoding (XOR) and create $mark[nT_b]$
2. $$s(t) = \left\{ \begin{array}{ll} 1, & for\ 0 \rightarrow T_b if\ b[nT_b] = 1 \\ 0, & for\ 0 \rightarrow T_b if\ b[nT_b] = 0 \end{array} \right\}$$

4. NRZ-M Polar

1. Mark based differential encoding (XOR) and create $mark[nT_b]$
2. $$s(t) = \left\{ \begin{array}{ll} 1, & for\ 0 \rightarrow T_b if\ b[nT_b] = 1 \\ -1, & for\ 0 \rightarrow T_b if\ b[nT_b] = 0 \end{array} \right\}$$

5. NRZ-S Unipolar

1. Space Based differential encoding (XNOR) and create $space[nT_b]$
2.
$$s(t) = \left\{ \begin{array}{ll} 1, & for\ 0 \rightarrow T_b if\ b[nT_b] = 1 \\ 0, & for\ 0 \rightarrow T_b\ if\ b[nT_b] = 0 \end{array} \right\}$$

6. NRZ-S Polar

1. Space Based differential encoding (XNOR) and create $space[nT_b]$
2.
$$s(t) = \left\{ \begin{array}{ll} 1, & for\ 0 \rightarrow T_b if\ b[nT_b] = 1 \\ -1, & for\ 0 \rightarrow T_b\ if\ b[nT_b] = 0 \end{array} \right\}$$

7. NRZ-AMI

$$s(t) = \left\{ \begin{array}{ll} \pm 1, & for\ 0 \rightarrow T_b\ if\ b[nT_b] = 1, \text{where sign toggles for every occurance of 1} \\ 0, & for\ 0 \rightarrow T_b\ if\ b[nT_b] = 0 \end{array} \right\}$$

8. RZ-Unipolar

$$s(t) = \left\{ \begin{array}{ll} 1, & for\ 0 \rightarrow \frac{t_b}{2}\ if\ b[nt_b] = 1 \\ 0, & for \frac{t_b}{2} \rightarrow t_b \\ 0, & for\ 0 \rightarrow t_b if\ b[nt_b] = 0 \end{array} \right\}$$

9. RZ-Bipolar

$$s(t) = \left\{ \begin{array}{ll} 1, & for\ 0 \rightarrow \frac{t_b}{2}\ if\ b[nt_b] = 1 \\ 0, & for \frac{t_b}{2} \rightarrow t_b \\ -1, & for\ 0 \rightarrow \frac{t_b}{2}\ if\ b[nt_b] = 0 \\ 0, & for\ 0 \rightarrow \frac{t_b}{2}\ if\ b[nt_b] = 0 \end{array} \right\}$$

10. RZ-AMI

$$s(t) = \left\{ \begin{array}{ll} \pm 1, & for\ 0 \rightarrow \frac{T_b}{2}\ if\ b[nT_b] = 1, \text{where sign toggles for every occurance of 1} \\ 0, & for\ \frac{T_b}{2} \rightarrow T_b\ if\ b[nT_b] = 0 \\ 0, & for\ 0 \rightarrow T_b\ if\ b[nT_b] = 0 \end{array} \right\}$$

11. Manchester

$$s(t) = \left\{ \begin{array}{ll} 1, & for\ 0 \rightarrow \frac{T_b}{2}\ if\ b[nT_b] = 1 \\ -1, & for\ \frac{T_b}{2} \rightarrow T_b\ if\ b[nT_b] = 1 \\ -1, & for\ 0 \rightarrow \frac{T_b}{2}\ if\ b[nT_b] = 0 \\ 1, & for\ \frac{T_b}{2} \rightarrow T_b\ if\ b[nT_b] = 0 \end{array} \right\}$$

1. Bandwidth, probability of error, power, selfclocking, error correction

Experiment – 4

Q1. Compare the different line codes with respect to the bandwidth they use

Q2. Compare the different line codes with respect to the probability of error they may have

Q3. Site a specific application of each of these line codes

Figure 1: Image

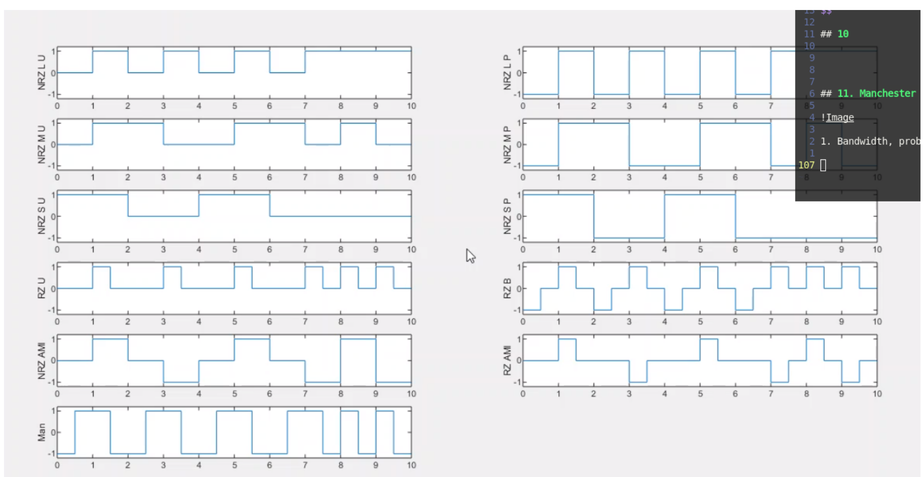

Figure 2: Image