NUIST Experiment Report

Course name IOT communication Technology

Experiment name Implementing Digital Baseband Signal Encoding with NRZ Experiment in MATLAB

Date 2024/5/22 Tuitor 谈玲

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1. Experimental objective

   Learn to use MATLAB software for simple simulation, improve students' practical hands-on and programming skills through experiments, and lay a good foundation for future communication work.

2. Experimental equipment

   2.1. Communication principle test box (FSK modem module);

   2.2. Oscillograph.

3. Experimental procedure (content）

   Observe the waveforms after modulation and demodulation of 2FSK, and record the waveforms after transmission and demodulation.

4. Experimental result

   4.1. Draw the curve of the function y=xe-x for x in the range of 0≤x≤

1.

4.1.1. Code

```
x=0:0.1:1    %定义自变量的采样点取值数组
y=x.*exp(-x) %利用数组运算计算各自变量采样点上的函数值
plot(x,y),xlabel('x'),ylabel('y'),title('y=x*exp(-x)') %绘图
```

4.1.2. Output

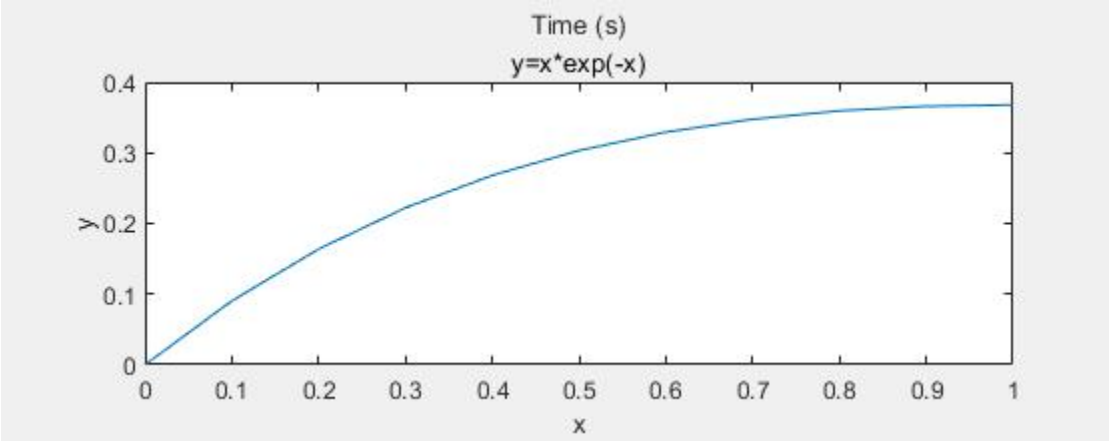

Figure 1: The output of the function

4.2.The code：

4.2.1. Setting basic parameters

```
% 设置比特流
bitStream = [1 0 1 1 0 1 0 0 1 1];

% 设置比特速率
bitRate = 1; % 比特每秒

% 每个比特的时间
bitPeriod = 1 / bitRate;

% 采样率（每个比特的采样点数）
samplingRate = 100;

% 生成时间向量
t = 0:1/samplingRate:(length(bitStream)*bitPeriod) - 1/samplingRate;
```

4.2.2. Generate NRZ unipolar non-return to zero code.

```
% 初始化 NRZ 单极性编码信号
nrz_unipolar = zeros(1, length(t));

% 生成 NRZ 单极性编码信号
for i = 1:length(bitStream)
    if bitStream(i) == 1
        nrz_unipolar((i-1)*samplingRate+1:i*samplingRate) = 1;
    else
        nrz_unipolar((i-1)*samplingRate+1:i*samplingRate) = 0;
    end
end

% 绘制 NRZ 单极性编码信号
figure;
subplot(2,1,1);
plot(t, nrz_unipolar, 'LineWidth', 2);
title('NRZ Unipolar Encoding');
xlabel('Time (s)');
ylabel('Amplitude');
grid on;
```

4.2.3. Generate NRZ unipolar non-return to zero code.

```
% 初始化 NRZ 双极性编码信号
nrz_bipolar = zeros(1, length(t));

% 定义当前电平
currentLevel = 1;

% 生成 NRZ 双极性编码信号
for i = 1:length(bitStream)
    if bitStream(i) == 1
        nrz_bipolar((i-1)*samplingRate+1:i*samplingRate) = currentLevel;
        % 反转电平
        currentLevel = -currentLevel;
    else
        nrz_bipolar((i-1)*samplingRate+1:i*samplingRate) = 0;
    end
end

% 绘制 NRZ 双极性编码信号
subplot(2,1,2);
plot(t, nrz_bipolar, 'LineWidth', 2);
title('NRZ Bipolar Encoding');
xlabel('Time (s)');
ylabel('Amplitude');
grid on;
```

4.2.4. output

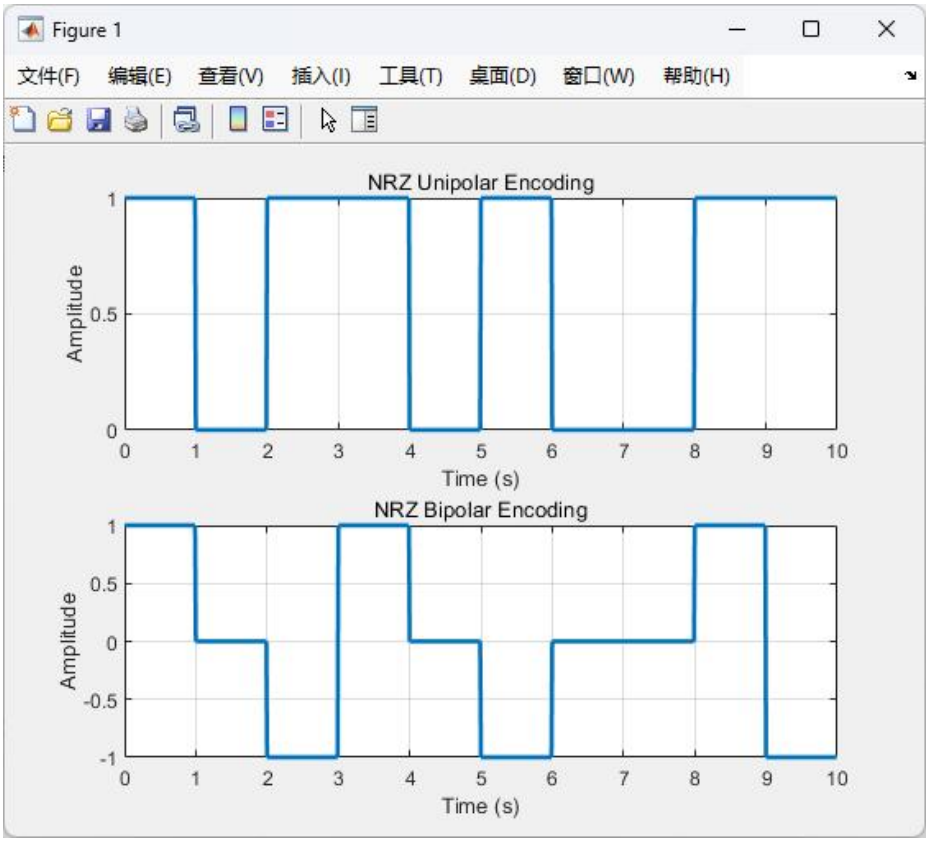

Figure 2：单极性不归零码和双极性不归零码

4.3.学习使用 simulink 进行仿真建模

4.3.1. Simulink figure

Figure 3: Simulink figure

4.3.2. Output

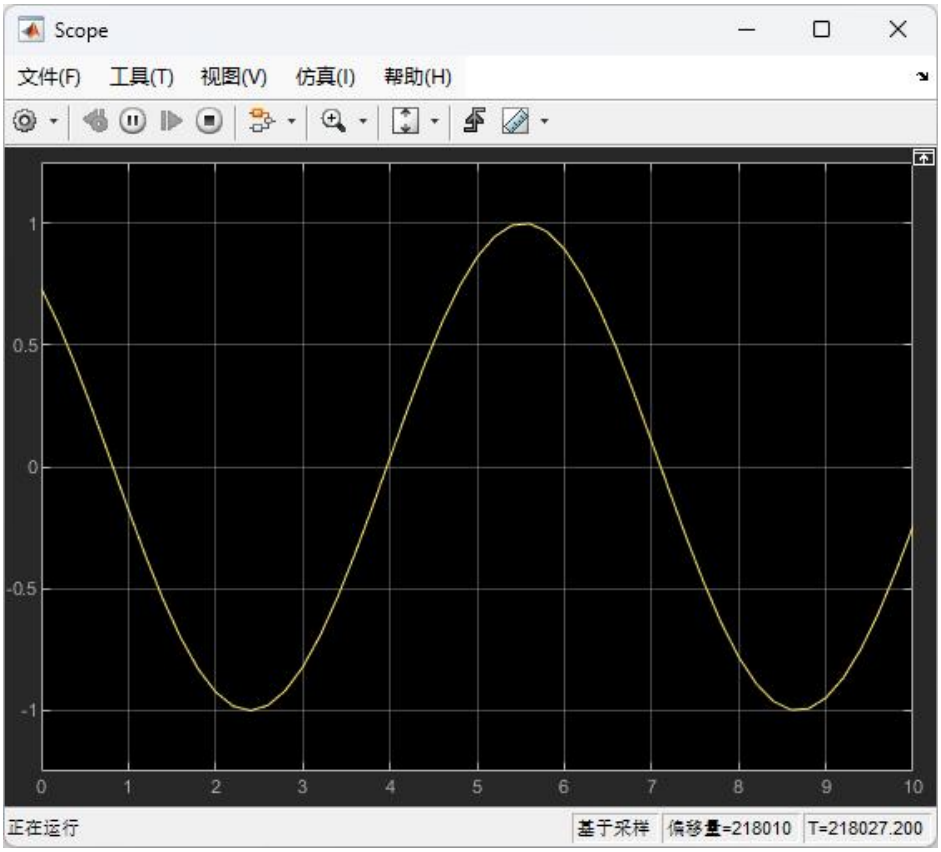

Figure 4: Output of simulink