Lab #10
TO DESIGN A BPSK TRANSMITTER USING CARRIER MODULATION

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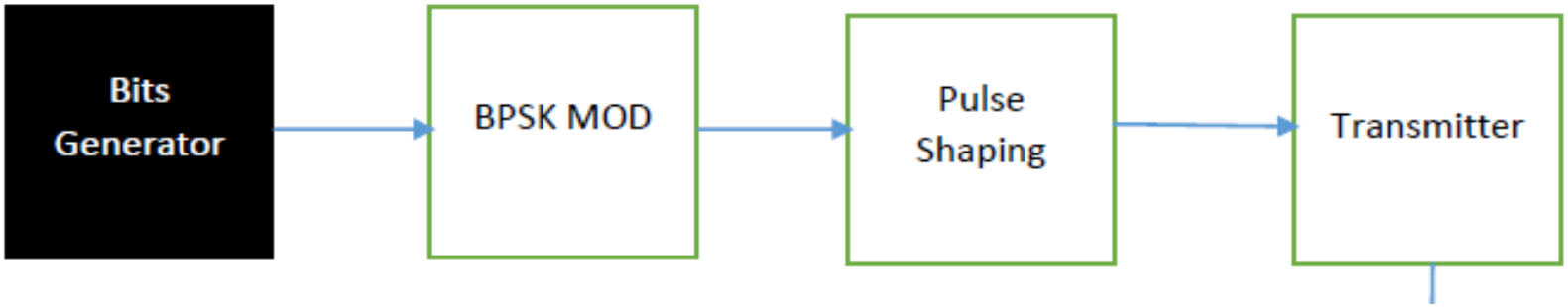
Objective

- The main objective of his lab is to design BPSK transmitter of digital communication system

BPSK Transmitter

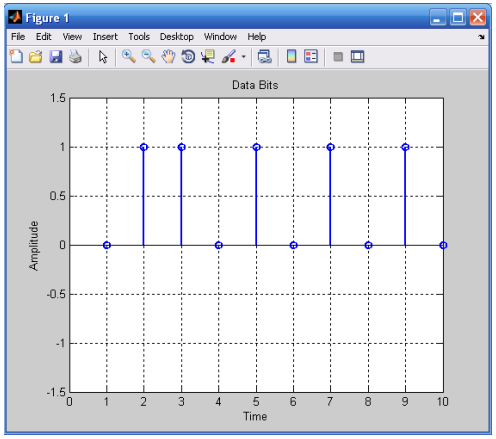


Bits Generator

- Binary Bit Pattern is a combination of binary digits arranged in a sequence.
- In MATLAB rand, randint and randi functions are used to create sequences of random integers and numbers.

Bits Generator

```
1. N_bits=10;
2. Ts=1;
3. t=linspace(0,1,100);
4. bits=randi([0,1],1,N_bits);
5. figure();
6. stem(bits,'linewidth',2);
7. xlabel('Time')
8. ylabel('Amplitude')
9. title('Data Bits')
10. axis([0 10 -1.5 1.5]);
11. grid on;
```

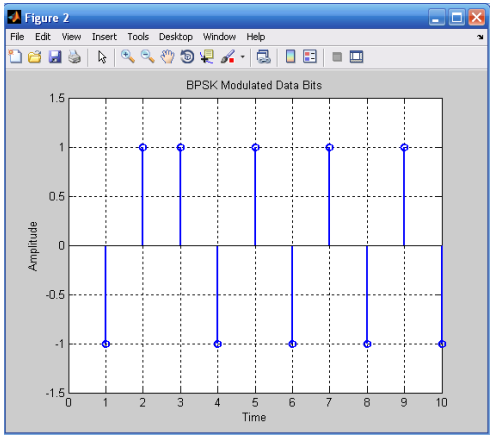


BPSK Modulation

- Binary phase shift keying (**BPSK**) is a common form of phase **modulation** that conveys data by changing the phase of the carrier wave

BPSK Modulator

1. bpsk_mod=2*bits-1;
2. figure();
3. stem(bpsk_mod,'linewidth',2);
4. xlabel('Time')
5. ylabel('Amplitude')
6. title('BPSK Modulated Data Bits')
7. axis([0 10 -1.5 1.5]);
8. grid on;

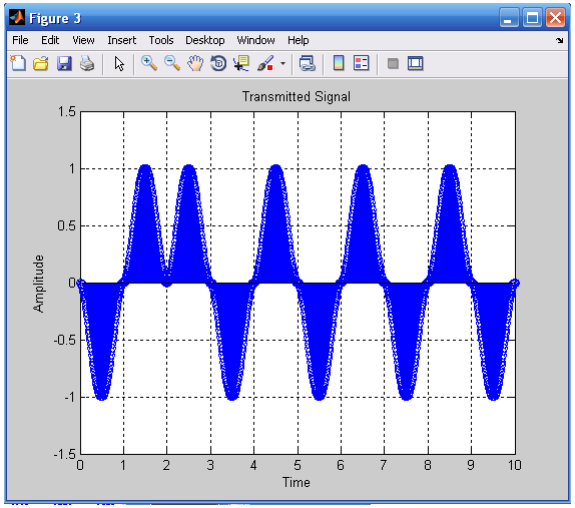


Pulse Shaping

- **Pulse shaping** is the process of changing the waveform of transmitted **pulses**. Its purpose is to make the transmitted signal better suited to its purpose or the communication channel, typically by limiting the effective bandwidth of the transmission.

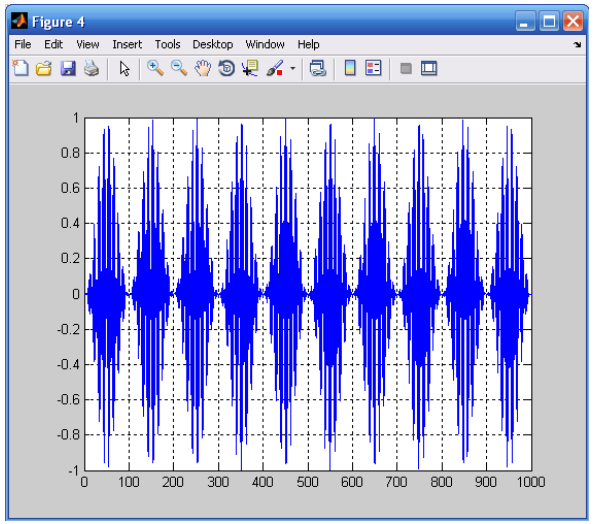
RC Pulse Shaping

```
1.  Tx=[];
2.  rc_pulse=0.5*(1-cos(2*pi*t));
3.  for i=1:N_bits
4.      Tx_sig=bpsk_mod(i)*rc_pulse;
5.      Tx=[Tx,Tx_sig];
6.  end
7.  figure();
8.  stem(linspace(0,10,length(Tx)),Tx);
9.  xlabel('Time')
10. ylabel('Amplitude')
11. title('Transmitted Signal')
12. axis([0 10 -1.5 1.5]);
13. grid on;
```



Generation Of Carrier

```
1. fc=1000;
2. tc=1:length(Tx);
3. fs=2200;
4. ts=1/fs;
5. to=ts*tc;
6. carrier=cos(2*pi*fc*to);
7. carrier_mod=Tx.*carrier;
8. figure();
9. plot(carrier_mod);
10. grid on
```



Conclusion

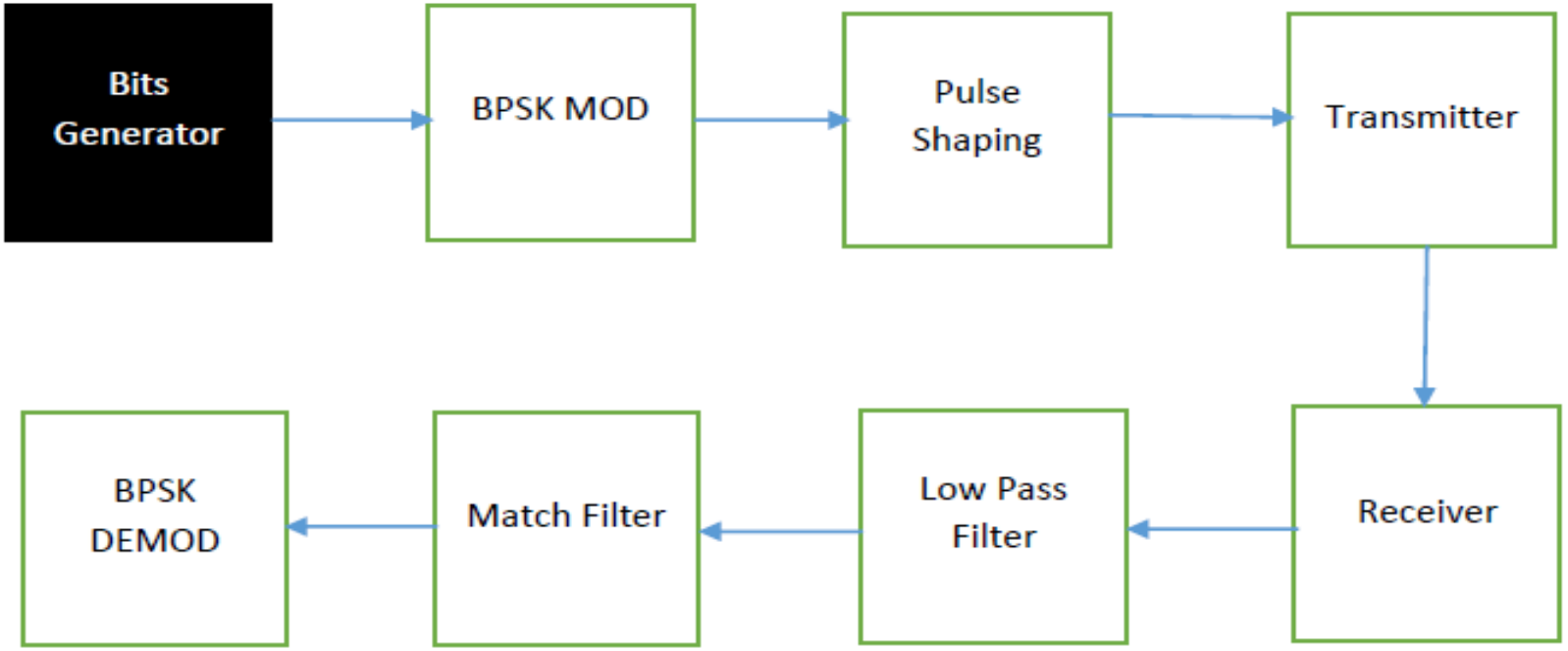
- We designed the BPSK transmitter for digital communication system.

Lab #11
TO DESIGN BPSK RECEIVER USING MACTHED FILTER

Objective

The basic objective of this lab is to design the basic bpsk receiver using matched filter.

BPSK Reciever



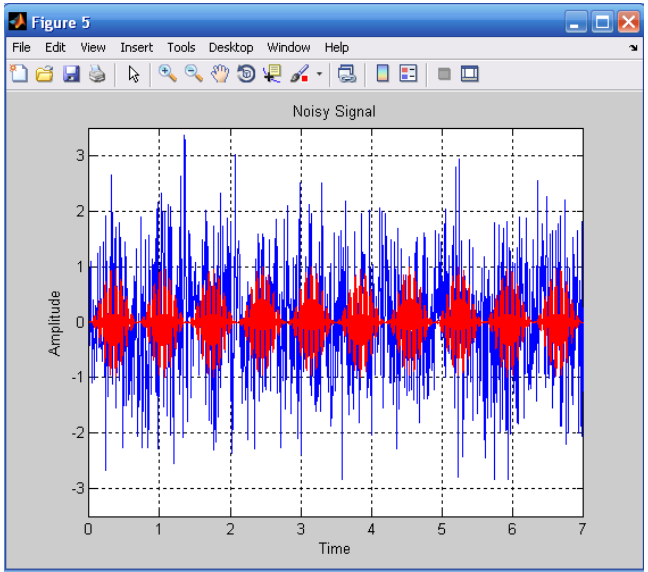
Matched Filter

- The **matched filter** is the optimal linear **filter** for maximizing the signal to noise ratio (SNR) in the presence of additive stochastic noise. **Matched filters** are commonly used in radar, in which a known signal is sent out, and the reflected signal is examined for common elements of the out-going signal.

- **Signal-to-noise ratio** (abbreviated **SNR** or S/N) is a measure used in science and engineering that compares the level of a desired signal to the level of background noise

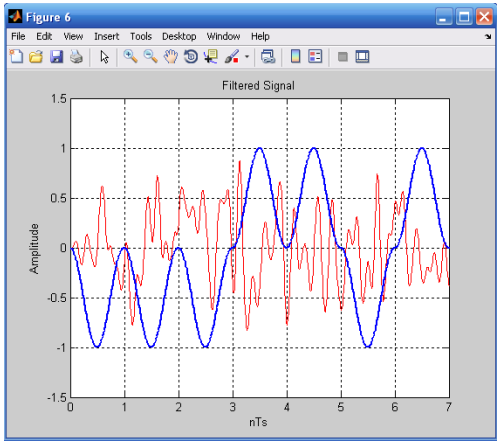
Receiver Side

```
1.  %% Generation of Noise Signal
2.  noise=randn(1,length(Tx));
3.  noisy=carrier_mod+noise;
4.  figure();
5.  plot(linspace(0,7,length(noisy)),noisy,'b');
6.  hold on
7.  plot(linspace(0,7,length(Tx)),carrier_mod,'r');
8.  hold off
9.  xlabel('Time')
10. ylabel('Amplitude')
11. title('Noisy Signal')
12. axis([0 7 -3.5 3.5]);
13. grid on;
```



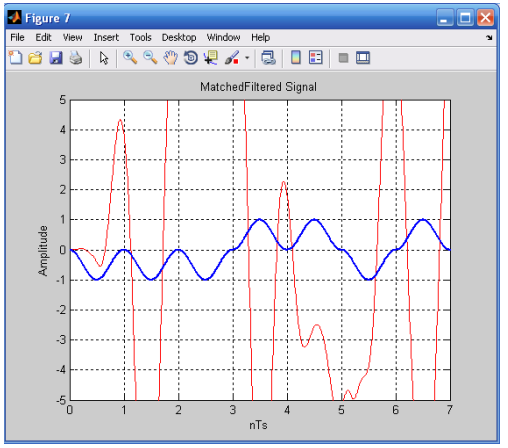
Low Pass Filter

```
1.  %% Low Pass Filter
2.  [num,den]=butter(5,0.1);
3.  LPF_Rx=filter(num,den,noisy);
4.  figure();
5.  plot(linspace(0,N_bits,length(LPF_Rx)),LPF_Rx,'r','linewi
    dth',0.5);
6.  hold on
7.  plot(linspace(0,N_bits,length(Tx)),Tx,'linewidth',2.00)
8.  hold off
9.  grid on
10. axis([0 7 -1.5 1.5])
11. xlabel('nTs')
12. ylabel('Amplitude')
13. title('Filtered Signal')
```



Matched Filter

```
1.  %% Matched Filter
2.  mat_fil=conv(rc_pulse,LPF_Rx);
3.  figure();
4.  plot(linspace(0,N_bits,length(mat_fil)),mat_fil,'r');
5.  hold on
6.  plot(linspace(0,N_bits,length(Tx)),Tx,'linewidth',2.00)
7.  hold off
8.  grid on
9.  axis([0 7 -5 5])
10. xlabel('nTs')
11. ylabel('Amplitude')
12. title('MatchedFiltered Signal')
```



Conclusion

- We designed the BPSK receiver using matched filter and observed the output of theoretical and simulated BER.