ESE- 3014

LAB1

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1. Create a 5x1 vector of zeros. Create a 2x5 matrix of random numbers

```
>> A = zeros(5,1)
A =

   0
   0
   0
   0
   0
```

```
>> B = rand(2,5)
B =

   0.507393   0.050856   0.507896   0.656286   0.785161
   0.643534   0.474826   0.302026   0.917875   0.948643
```

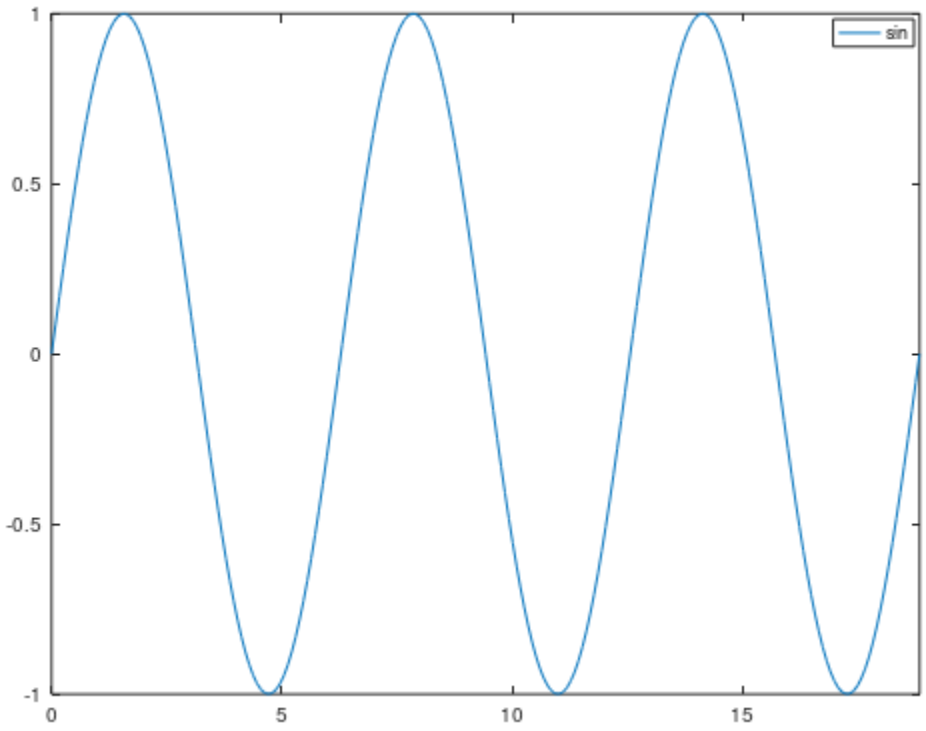
2. Multiply a column of a matrix with an element of this same matrix.

3. Create a plot of the sin function between 0 and 6π.

```
>> B(:,1)=B(:,1)*B(1,1)
B =

   0.257448   0.050856   0.507896   0.656286   0.785161
   0.326525   0.474826   0.302026   0.917875   0.948643
```

3. Create a plot of the sin function between 0 and 6π.

>> fplot(@sin,[0,6*pi])

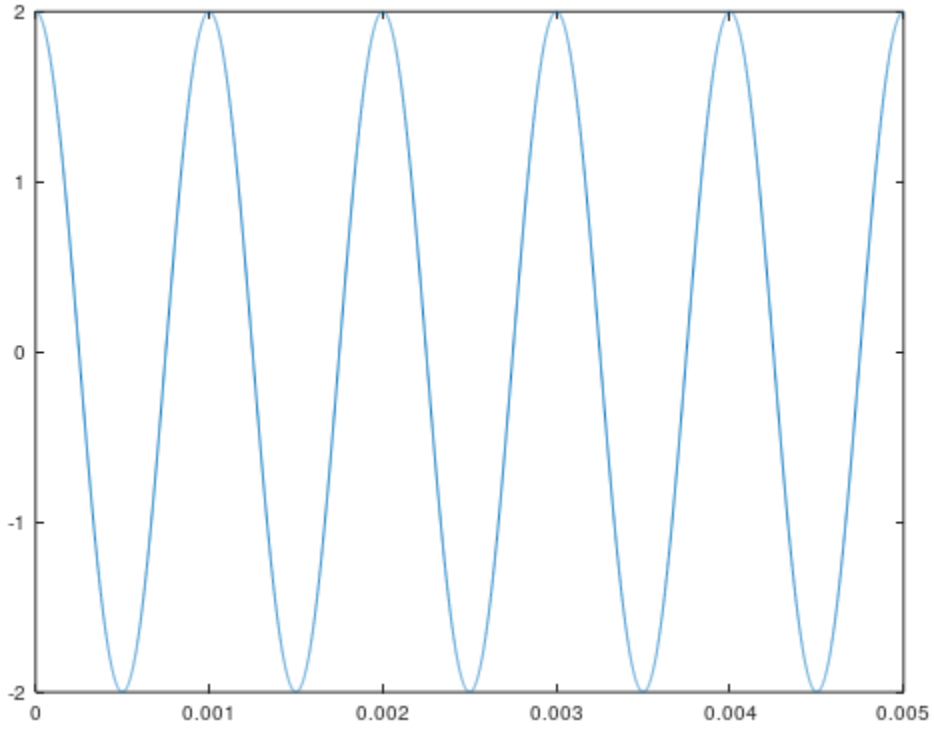


4. Simulate an amplitude modulation (AM) system with all input, carrier and output signals. Say the input signal is a cosine wave with amplitude as 2V and frequency as 1000Hz. The carrier signal is also a cosine wave with amplitude as 5V and frequency as 10KHz. The modulation degree is 0.5, and the initial phases of all cosine wave are 0. (Recall Nyquist sampling theorem to avoid distortion i.e. under sampling)

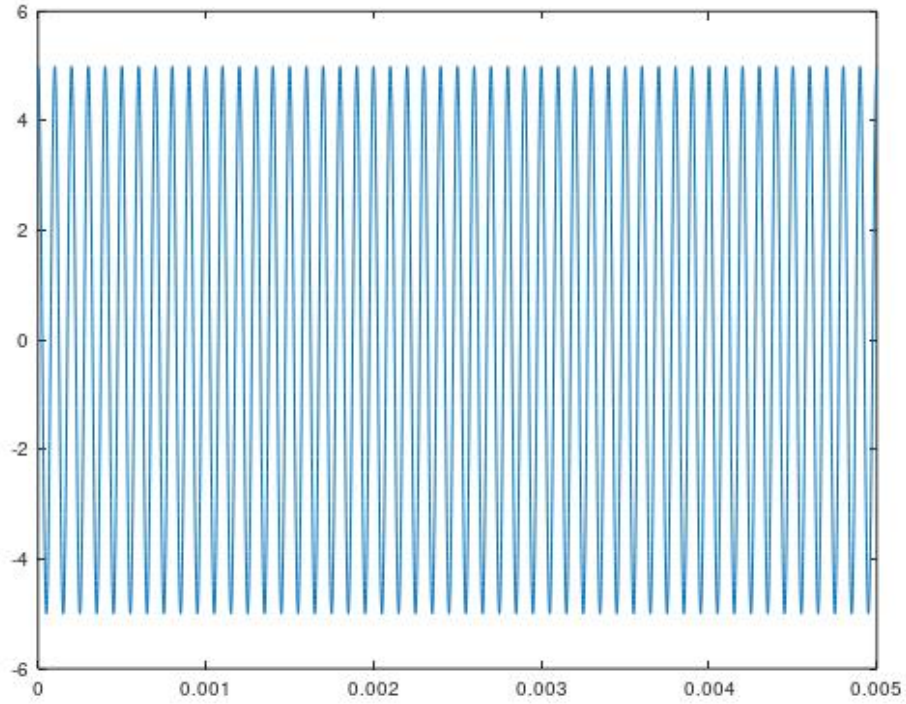
```
>> iA = 2;%amplitude of input signal

>> iF = 1000;%frequency of input signal

>> iT = 1/iF;%time period of input signal

>> cA = 5;%Amplitude of carrier signal

>> cF = 10^4;%Frequency of carrier signal

>> cT = 1/cF;%time period of carrier signal

>> iT1 = 0:iT/1000:(5*iT);

>> inY = iA*cos(2*pi*iF*iT1); %input signal

>> plot(iT1,inY) %plotting the input signal

>> cY = cA*cos(2*pi*cF*cT1);%carrier signal

>> plot(cT1,cY)%plotting carrier signal

>> m =0.5;%modulation index
```

```
>> Am = (1+m.*(cos(2*pi*iF*iT1))).*(cA*cos(2*pi*cF*iT1));%output signal
>> plot(iT1,Am);%plotting output signal
```

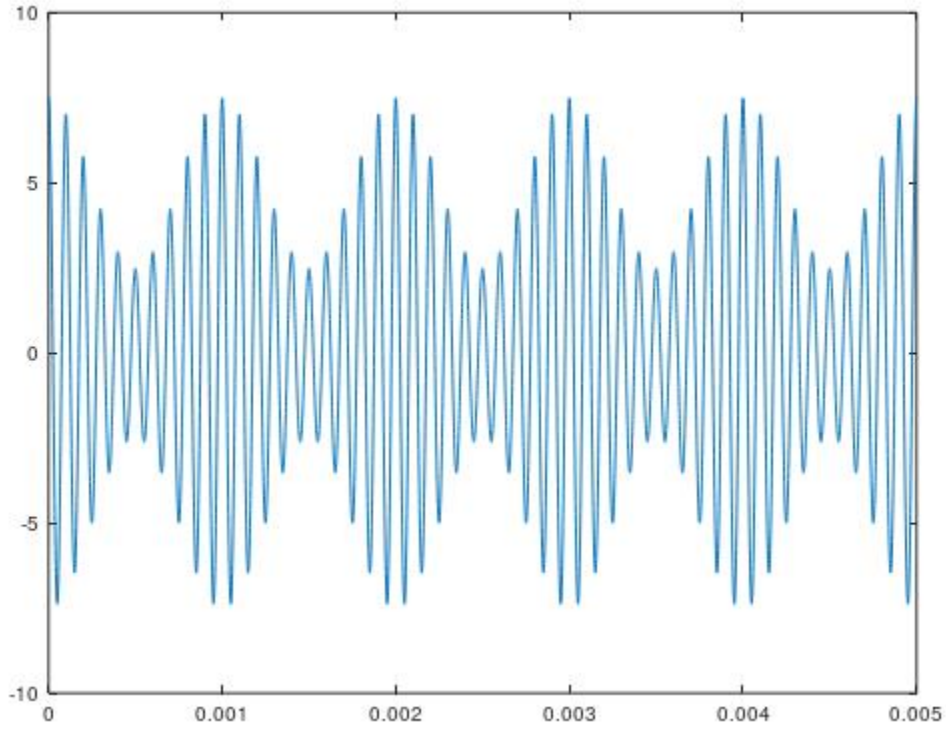
input signal



carrier signal



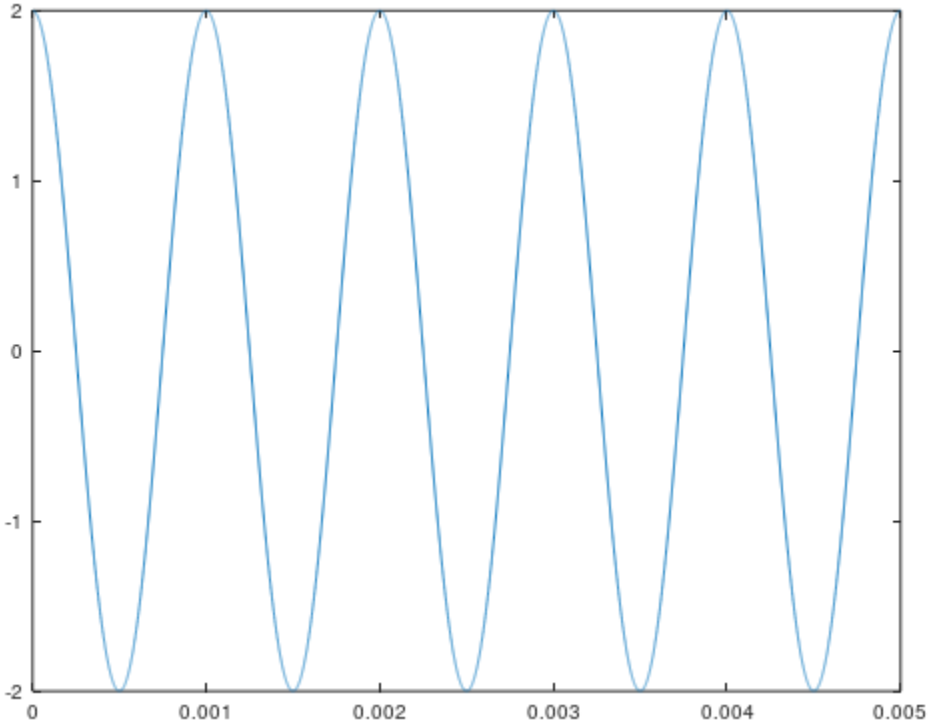
Output signal



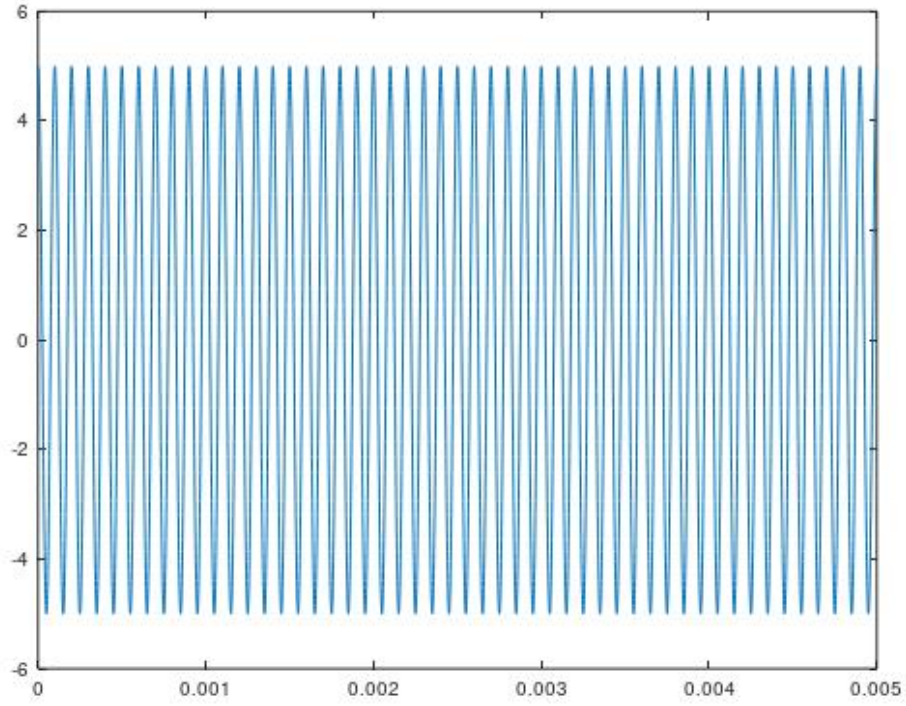
5. Use the signals above, consider a actual vivid simulation mode, and add random noise in output signal. In this simulation, we divide time domain into several duration, and call each duration as frame. The scanning cycle of an oscilloscope is equal to frame period, that means each time we simulate a frame of signal, and the display will be refreshed once. Therefore, we can get a constantly sliding input signal, a carrier signal with phase jitter, and output signal with noise.

```
>> iA = 2;%amplitude of input signal
>> iF = 1000;%frequency of input signal
>> iT = 1/iF;%time period of input signal
>> cA = 5;%Amplitude of carrier signal
>> cF = 10^4;%Frequency of carrier signal
>> cT = 1/cF;%time period of carrier signal
>> iT1 = 0:iT/1000:(5*iT);
>> inY = iA*cos(2*pi*iF*iT1); %input signal
>> plot(iT1,inY) %plotting the input signal
>> cY = cA*cos(2*pi*cF*cT1);%carrier signal
>> plot(cT1,cY)%plotting carrier signal
>> m =0.5;%modulation index
>> Am = (1+m.*(cos(2*pi*iF*iT1))).*(cA*cos(2*pi*cF*iT1));%output signal
>> plot(iT1,Am);%plotting output signal
>> AmN = rand(size(Am)) + (1+m.*(cos(2*pi*iF*iT1))).*(cA*cos(2*pi*cF*iT1));%adding noise to the
original signal
>> plot(iT1,AmN);%plotting the signal with noise
```

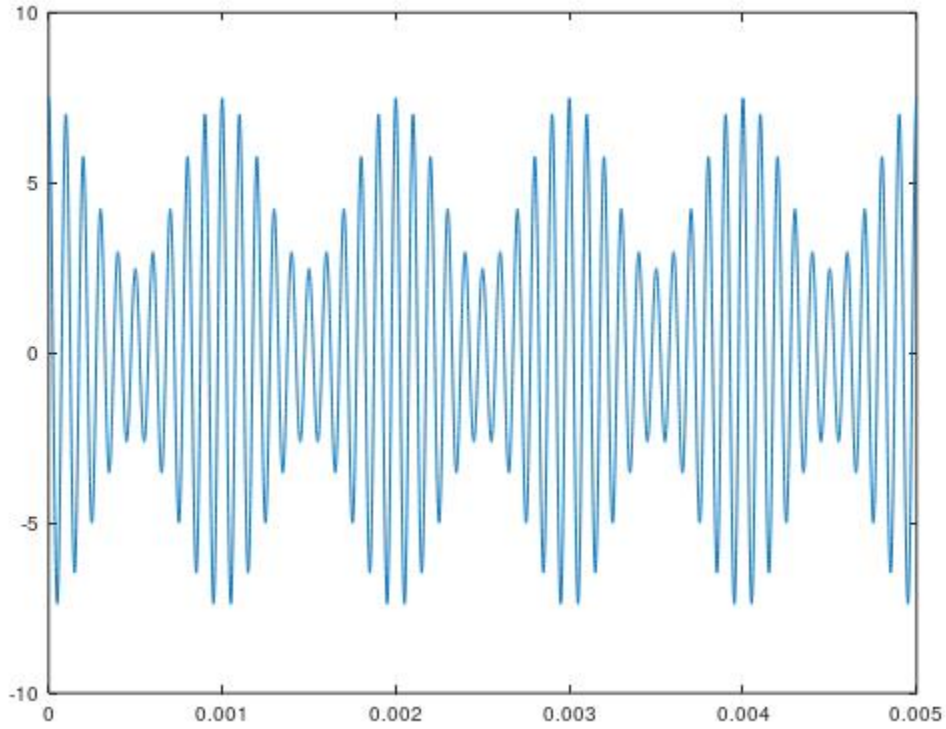
input signal



carrier signal



Output signal without noise



Output signal with noise