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194107 ECE-A

CS LAB
Pulse Width Modulation

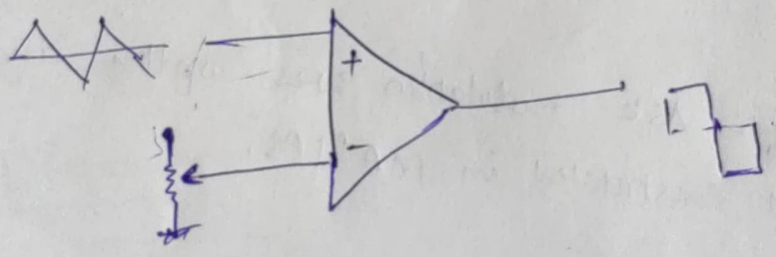
Aim :- To develop a MATLAB program for pulse width modulation of given message of a given message signals.

Tools - MATLAB R2021b.

Theory - PWM uses digital signal to control power application. Digital system don't generally generate as much heat. Almost all the heat generated by a switching device is duration the transition which is quickly done. while the device is neither on or off. but in b/w. This is because power follows this formula

$$P = \text{voltage} * \text{Current}$$

If either of voltage or current tends to zero, power will approach zero.



Procedure

(1) A sinusoidal message signal was taken of freq. 20 Hz and amplitude equal to 1V.

(2) for the carrier, a sawtooth signal of f=40 Hz and amplitude 3V was generated.

(3) The carrier signal decides the sampling rate of PWM and hence freq. was taken at least twice

of message frequency.

4). A total of 1000 time value were taken 0 to 1 in step of 0.0001.

5) sawtooth() and sine() function were used to generate the samples and message signals respectively.

6) Now, PWM logic must be logic high when the value of the message exceeds that of the carrier, other wise zero.

7) Using this logic and a 'pwm' variable the required values of the PWM wave were obtained.

8) finally, the three signals (sinusoidal message, sawtooth Carrier, resultant PWM waveform) were successfully all plotted during plot() function.

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Result - The MATLAB program for PWM was developed and the plots were obtained successfully.

```
clc;
close all;
t = 0:0.001:1;
fc = input( 'Enter the Frequency of Carrier Signal (Sawtooth) = ' );
fm = input( 'Enter the Frequency of Message Signal (Sinusoidal) = ' );
a = input( 'Enter the Amplitude of Carrier Signal = ' );
b = input( 'Enter the Amplitude of Message Signal(should be < Carrier)=');
vc = a.*sawtooth(2*pi*fc*t);
vm = b.*sin(2*pi*fm*t);
n = length(vc);
for i = 1:n
    if (vm(i)>=vc(i))
        pwm(i) = 1;
    else
        pwm(i) = 0;
    end
end

% Representation of the Message Signal
subplot(3,1,1);
plot(t,vm, 'black' );
xlabel( 'Time ----->' );
ylabel( 'Amplitude ----->' );
title( 'Message Signal' );
legend( 'Message Signal ---->' );
grid on ;

% Representation of the Carrier Signal
subplot(3,1,2);
plot(t,vc);
xlabel( 'Sample ----->' );
ylabel( 'Amplitude ----->' );
title( 'Carrier Signal' );
legend( 'Carrier Signal ---->' );
grid on ;

% Representation of the PWM Signal
subplot(3,1,3);
plot(t,pwm, 'red' );
xlabel( 'Sample ----->' );
ylabel( 'Amplitude ----->' );
title( 'PWM Signal' );
legend( 'PWM Signal ---->' );
axis([0 1 0 2]);
grid on ;

% Add title to the Overall Plot
ha = axes ( 'Position' ,[0 0 1 1], 'Xlim' ,[0 1], 'Ylim' ,[0 1], 'Box' , 'off' ,↙
'Visible' , 'off' , 'Units' , 'normalized' , 'clipping' ,'off' );
text (0.5, 1, '\bf Pulse Width Modulation' , 'HorizontalAlignment' , 'center' ,↙
'VerticalAlignment' , 'top' )
```

```
Enter the Frequency of Carrier Signal (Sawtooth) = 40
Enter the Frequency of Message Signal (Sinusoidal) = 20
Enter the Amplitude of Carrier Signal = 3
Enter the Amplitude of Message Signal(should be < Carrier)=1
>>
```

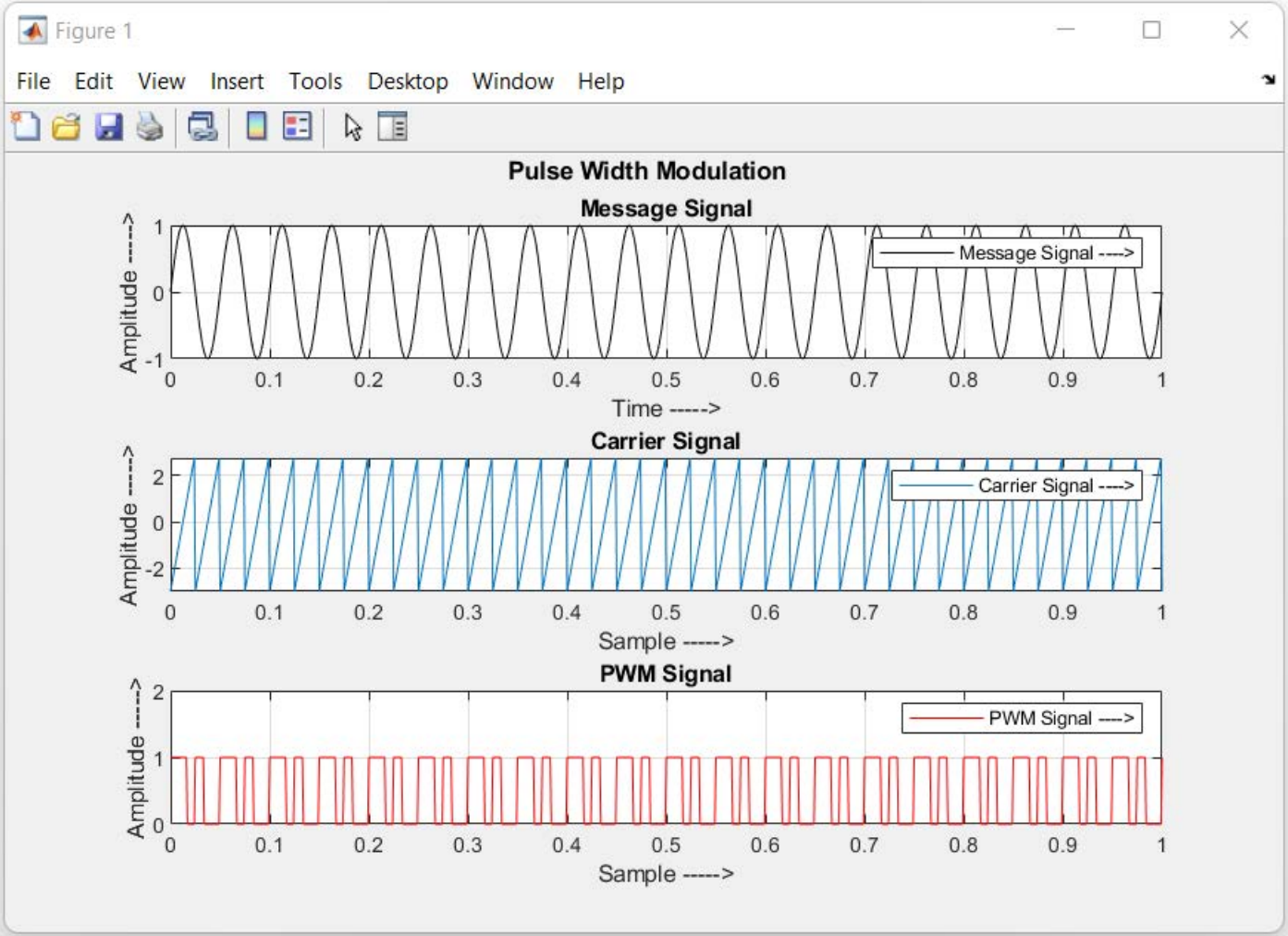

Figure 1

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