## Pulse width modulation

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This code was developed by Miodrag Bolic for the book PERVASIVE CARDIAC AND RESPIRATORY MONITORING DEVICES: https://github.com/Health-Devices/CARDIAC-RESPIRATORY-MONITORING. We acknowledge that we used the code developed by Sourangsu Banerji, 2013 at https://www.mathworks.com/matlabcentral/fileexchange/42168-pulse-width-modulation.

## **PWM Signal generation**

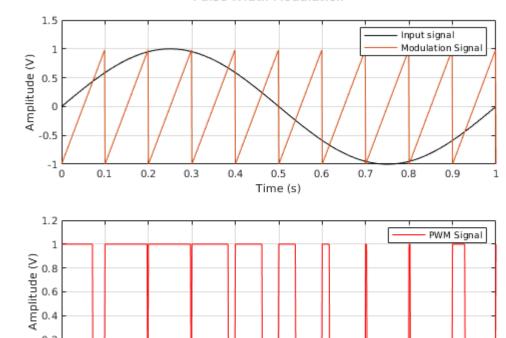
The code below shows a 10 Hz modulation waveform. The input signal is the sine wave with a frequency of 1 Hz. The code then generates the the output PWM signal.

```
% This code has been modified from Sourangsu Banerji, 2013 at
% https://www.mathworks.com/matlabcentral/fileexchange/42168-pulse-width-modulation

clc;
clear all;
t = 0:0.001:1;
fc = 10; % the Frequency of Carrier Signal
fm = 1; % Frequency of the input signal
a = 1; % Amplitude of Modulation signal
b = 1; % Amplitude of the input signal
vc = a.*sawtooth(2*pi*fc*t);
vm = b.*sin(2*pi*fc*t);
n = length(vc);
for i = 1:n
    if (vm(i)>=vc(i))
        pwml(i) = 1;
```

```
else
                             pwm1(i) = 0;
               end
end
% Representation of the Message Signal
subplot(2,1,1);
plot(t,vm,'black');
xlabel('Time (s)');
ylabel('Amplitude (V)');
ylim([-1, 1.5])
%title('Input Signal');
grid on;
% Representation of the Carrier Signal
hold on
plot(t,vc);
legend('Input signal', 'Modulation Signal');
grid on;
% Representation of the PWM Signal
subplot(2,1,2);
plot(t,pwm1,'red');
xlabel('Time (s)');
ylabel('Amplitude (V)');
%title('PWM Signal');
legend('PWM Signal');
ylim([0, 1.2])
%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',
text (0.5, 1, '\bf Pulse Width Modulation ', 'HorizontalAlignment', 'center', 'VerticalAlignment', 'verticalAlignme
exportgraphics(gcf, "Fig3.29.jpg", 'Resolution',600)
```





0.2

0

0.1

0.2

0.3

0.4

0.5

Time (s)

0.6

0.7

8.0

0.9