ROLES AND RESPONSIBILITIES

- Solved the governing equations of a pendulum to form a matrix system of equations in order to solve in matlab
- Developed a code using matlab to solve the governing equation of pendulum
- Developed a code to produce an animation of pendulum motion using matlab

CODE SNIPPETS AND RESULTS

EQUATION OF MOTION OF SIMPLE PENDULUM:

$$\frac{d^2\theta}{dt^2} + \frac{b}{m}\cdot\frac{d\theta}{dt} + \frac{g}{L}\cdot\sin\theta = 0$$

In the above equation:

g = gravity in m/s2,

L = length of the pendulum in m,

m = mass of the ball in kg,

b=damping coefficient

Considering:

$\theta = \theta 1$ equation 1

then

$$\frac{d\theta}{dt} = \frac{d\theta_1}{dt} = \theta 2 \text{ equation 1}$$

$$\frac{d^2\theta}{dt^2} = \frac{d^2\theta_1}{dt^2} = \frac{d}{dt}\left(\frac{d\theta_1}{dt}\right) = \frac{d}{dt}\theta_2 \text{ equation 2}$$

putting equation 1 & equation 2 in SIMPLE PENDULUM EQUATION

$$\frac{d^2\theta_1}{dt^2} + \frac{b}{m}\frac{d\theta_1}{dt} + \frac{g}{L}\sin\theta = 0$$

$$\frac{d\theta_2}{dt} + \frac{b}{m}\theta_2 + \frac{g}{L}\sin\theta_1 = 0$$

$$\frac{d\theta_2}{dt} = -\frac{b}{m}\theta_2 - \frac{g}{L}\sin\theta_1$$

Creating Matrix Equation:

$$\frac{d}{dt}\begin{bmatrix}\theta_1\\ \theta_2\end{bmatrix} = \begin{bmatrix}\theta_2\\ -\frac{b}{m}\theta_2 - \frac{g}{L}\sin\theta\end{bmatrix}$$

```
% solving the ode
[t,x] = ode45(@(t,theta) ode_func(t,theta,b,g,l,m), t_span,theta_0)

figure(1)
plot(t,x(:,1),'linewidth',3);
hold on
plot(t,x(:,2),'linewidth',3);
xlabel('time')
ylabel('Amplitude')
hold on ; grid on

%  using for loop
ct=1
ang_vel=x(:,1)
for i=1:length(ang_vel);
    ANG_VEL=ang_vel(i)
    x0=0;
    y0=0;
    x1=-l*sin(ANG_VEL)
    y1=-l*cos(ANG_VEL)

    % plot
    figure(2)
    plot([x0 x1],[y0,y1],'linewidth',3)
    hold on
    plot(x1,y1,'marker','o','markerfacecolor','r')
    axis([-1.5 1.5 -1.5 1.5])
    pause(0.03)
    hold off
    M(ct)=getframe(gcf);
    ct=ct+1;
end
movie(M)
videofile=VideoWriter('ode_main.avi','Uncompressed AVI')
open(videofile)
writeVideo(videofile,M)
```

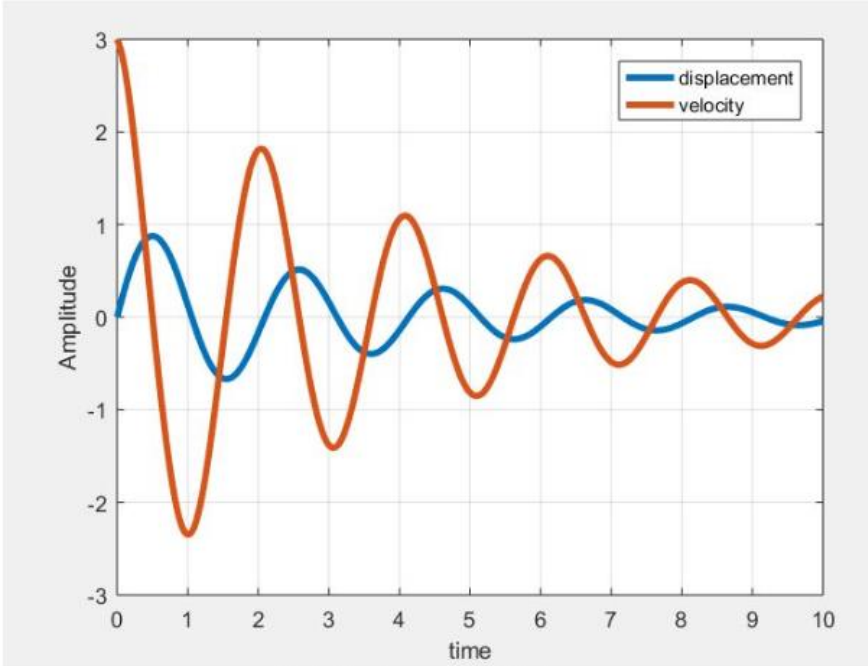

Fig 2- Displacement vs Velocity