clear; clc; close all;

hold on;

% Displacement

Pa2=-pi:pi/50:pi;

X=(-1.2\*sin(Pa2)+sqrt(((1.2\*sin(Pa2)).^2-(4)\*(0.36-0.48\*cos(Pa2)))))/(2);

X1=(-1.2\*sin(Pa2)-sqrt(((1.2\*sin(Pa2)).^2-(4)\*(0.36-0.48\*cos(Pa2)))))/(2);

figure(1);

hold on;

grid;

plot(Pa2,X);

plot(Pa2,X1);

xlabel('Psi 2 [radians]');

ylabel('Displacement [meters]');

plot(0,0.3464,'or');

legend('Displacement with +sqrt','Displacement with -sqrt','Displacement when Psi 2 = 0');

%Euler's forward method

h=0.1;

P1(1)=-pi;

P2(1)=-0.23914;

N=length([P1(1):h:pi]);

for n=1:N

P2(n+1)=P2(n)+h\*(Output\_Input\_Relation(P1(n),P2(n)));

P1(n+1)=P1(1)+n\*h;

end

axis equal;

figure(2);

hold on;

grid;

plot(P1,P2,'b');

plot(0,0,'or');

ylim\_P2=get(gca);

xlabel('Psi 1 (Input angle) [radians]');

ylabel('Psi 2 (Output angle) [radians]');

% Displacement:

X=(-1.2\*sin(P2)+sqrt(((1.2\*sin(P2)).^2-(4)\*(0.36-0.48\*cos(P2)))))/(2);

figure(3);

hold on;

grid;

plot(P2,X,'b');

ylim\_P2=get(gca);

xlabel('Psi 2 [radians]');

ylabel('Displacement [meters]');

plot(0,0.3464,'or');

% Velocity:

V= abs(0.5.\*(-1.2.\*cos(P2)+((1.44.\*sin(2\*P2)-1.92.\*sin(P2))/2.\*sqrt(1.44.\*(sin(P2)).^2-4.\*(0.36-0.48.\*cos(P2))))));

figure(4);

hold on;

grid;

plot(P2,V,'b');

ylim\_P2=get(gca);

xlabel('Psi 2 [radians]');

ylabel('Velocity [meters/seconds]');

figure(5);

hold on;

grid;

plot(P2,X,'b');

plot(P2,V, 'r');

plot(0,0.3464,'or');

xlabel('Psi 2 [radians]');

ylabel('Displacement, Velocity [meters, meters/seconds]');

legend('Displacement', 'Velocity', 'Displacement when Psi 2 = 0');

function f = Output\_Input\_Relation(P1,P2)

A=0.464;

f = (0.02\*cos(P1)+0.01\*sin(P1)+0.0224\*sin(A+P2-P1))/(0.0224\*sin(A+P2-P1)+0.0896\*cos(A+P2)+0.0448\*sin(A+P2));

end