Juan Franco EECE 212

Lab 9 Dynamic Systems

**Paste your const\_state\_1D.m function**

1. function [tsv] = const\_state\_1D(N,T,P,V,Ac)

p = zeros(1,N+1);

v = zeros(1,N+1);

q = zeros(3,N+1);

p(1) = P;

v(1) = V;

a = ones(1, N+1)\*Ac;

q(:,1) = [p(1);v(1);a(1)]; %State Vector

A = [1 T (T^2/2);0 1 T;0 0 1]; %State Transition Matrix

for n = 2:N+1

p(n) = .5 \* T.^2 \* a(1) + T \* v(n-1) + p(n-1); %Equation for

position

v(n) = T \* a(1) + v(n-1); %Equation for velocity

q(:,n) = A\*q(:,n-1);

end

tsv = q;

end

**Paste your plot MATLAB script (.m file) in question 1.6**

1. [tsv] = const\_state\_1D(100,0.1,10,0,1);

figure

plot(tsv(1,:))

hold on

title('Position vs. Time')

xlabel('Time')

ylabel('Position')

hold off

figure

plot(tsv(2,:))

hold on

title('Speed vs. Time')

xlabel('Time')

ylabel('Speed')

hold off

figure

plot(tsv(1,:),'DisplayName','Position')

hold on

plot(tsv(2,:),'DisplayName','Speed')

title('Position and Speed vs. Time')

xlabel('Time')

ylabel('Displacement and Distance per time')

hold off

legend

**Paste your plots from question 1.6**

3.







**Paste your const\_state\_3D.m function**

1. function [x,y,z] = const\_state\_3D(N,T,Px,Vx,Ax,Py,Vy,Ay,Pz,Vz,Az)

px = zeros(1,N+1);

vx = zeros(1,N+1);

py = zeros(1,N+1);

vy = zeros(1,N+1);

pz = zeros(1,N+1);

vz = zeros(1,N+1);

q = zeros(9,N+1);

px(1) = Px;

vx(1) = Vx;

ax = ones(1, N+1)\*Ax;

py(1) = Py;

vy(1) = Vy;

ay = ones(1, N+1)\*Ay;

pz(1) = Pz;

vz(1) = Vz;

az = zeros(1, N+1)\*Az;

q(:,1) = [px(1);vx(1);ax(1);py(1);vy(1);ay(1);pz(1);vz(1);az(1)];

A = [1 T (T^2/2) 0 0 0 0 0 0;0 1 T 0 0 0 0 0 0;0 0 1 0 0 0 0 0 0;...

%State Transition Matrix

0 0 0 1 T (T^2/2) 0 0 0;0 0 0 0 1 T 0 0 0;0 0 0 0 0 1 0 0 0;...

0 0 0 0 0 0 1 T (T^2/2);0 0 0 0 0 0 0 1 T;0 0 0 0 0 0 0 0 1];

for n = 2:N+1

px(n) = .5 \* T.^2 \* ax(1) + T \* vx(n-1) + px(n-1); %Equation for

position of x

vx(n) = T \* ax(1) + vx(n-1); %Equation for velocity of x

py(n) = .5 \* T.^2 \* ay(1) + T \* vy(n-1) + py(n-1); %Equation for

position of y

vy(n) = T \* ay(1) + vy(n-1); %Equation for velocity of y

pz(n) = .5 \* T.^2 \* az(1) + T \* vz(n-1) + pz(n-1); %Equation for

position of z

vz(n) = T \* az(1) + vz(n-1); %Equation for velocity of z

q(:,n) = A\*q(:,n-1); %Equation for time-varying state vector of

x,y,z

end

x = q(1:3,:);

y = q(4:6,:);

z = q(7:9,:);

end

**Paste your plot matlab script (.m file) in question 2.6**

1. [x,y,z] = const\_state\_3D(100,0.1,10,0,1,10,0,1,0,10,0);

figure

plot3(x(1,:),y(1,:),z(1,:))

hold on

title('x-position vs y-position vs z-position')

xlabel('x-position')

ylabel('y-position')

zlabel('z-position')

**Paste your plots from question 2.6**

