

https://docs.google.com/forms/d/e/1FAIpQLScOYFEvJQ8fn9i_g58dNHLdVBqescy-cOxunROHvXgU105ZLQ/viewform?usp=sharing

Roll No: 2022_mc_58

-----(Assesment2) -----

Part A

Algorithm:-

function dy= fun(t,y)

f=5;

m1=1;

m2=4;

k1=4;

k2=5;

k3=0;

fv1=3;

fv2=3;

fv3=2;

dy(1)=y(2);

dy(3)=y(4);

dy(2)=1/m1*(f-(k1+k2)*y(1)-(fv1+fv3)*y(2)+fv3*y(4)+k2*y(3));

dy(4)=1/m2*(-(fv2+fv3)*y(4)-(k2+k3)*y(3)+k2*y(1)+fv3*y(2));

dy=dy';

end

clc;

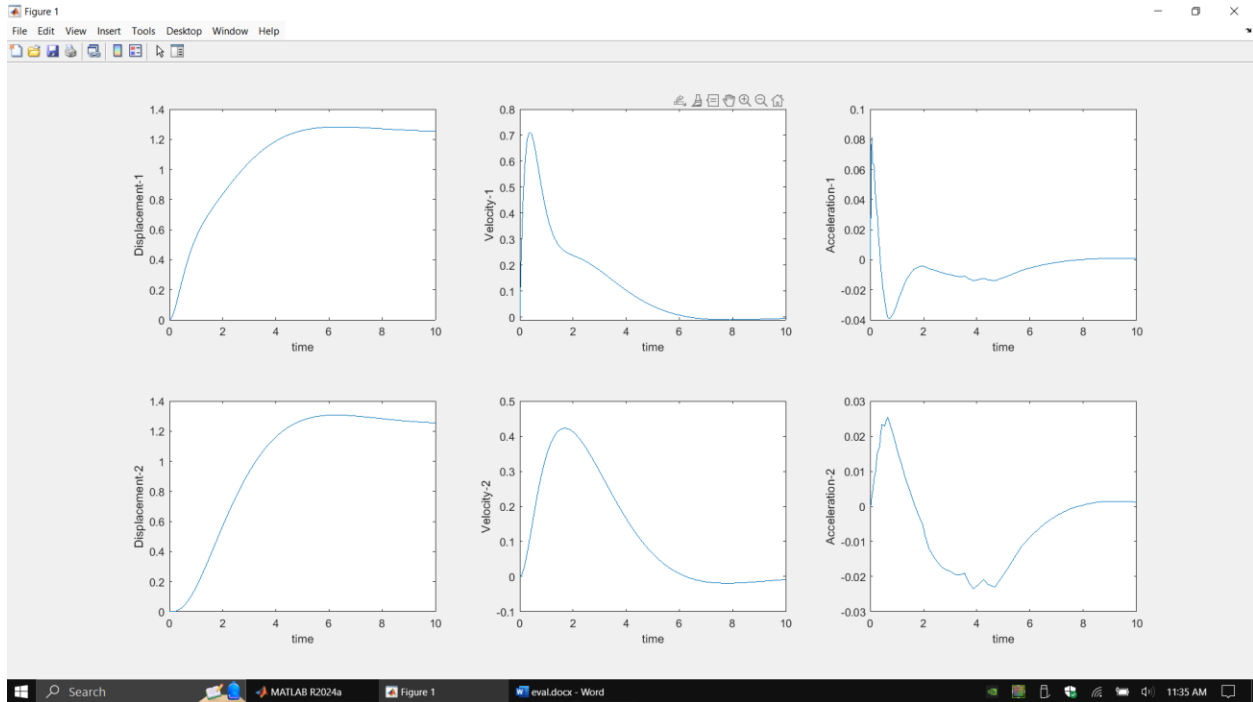
TR = [0 10];

X0 = [0;0;0;0]; %intial condition zero

[t,y]=ode45(@fun,TR,X0);

x1=y(:,1);

```
v1=y(:,2);
x2=y(:,3);
v2=y(:,4);
a1=gradient(v1);
a2=gradient(v2);
subplot(2,3,1)
plot(t,x1)
xlabel('time')
ylabel('Displacement-1')
subplot(2,3,2)
plot(t,v1)
xlabel('time')
ylabel('Velocity-1')
subplot(2,3,3)
plot(t,a1)
xlabel('time')
ylabel('Acceleration-1')
subplot(2,3,4)
plot(t,x2)
xlabel('time')
ylabel('Displacement-2')
subplot(2,3,5)
plot(t,v2)
xlabel('time')
ylabel('Velocity-2')
subplot(2,3,6)
plot(t,a2)
xlabel('time')
ylabel('Acceleration-2')
```



----- (Assesment3) -----

Part A

Algorithm:-

```
function dy= randFun2(t,y,T,J1,J2,J3,m,r,fv,k1,k2,d3)
```

```
dy(1)=y(2);
```

```
dy(3)=y(4);
```

```
dy(5)=y(6);
```

```
dy(2)=1/J1*(T - k1*y(1) + k1*y(3));
```

```
dy(4)=1/(J2+m*r*r)*(k1*y(1) - (d3+fv*r^2)*y(4) -(k1+k2*r^2)*y(3) + d3*y(6));
```

```
dy(6)=1/J3*(d3*(y(4)-y(6)));
```

```
dy=dy';
```

```
end
```

```
clc ;
```

```
% Transfer function (Theta_gear(s) / T(s))
```

```
num = [1];      % Numerator
```

```
den = [J1 0 k1]; % Denominator
```

```
% Create transfer function
```

```
sys_tf = tf(num, den)
```

```
% State-space matrices
```

```
A = [0 1 0 0 0 0;
```

```
      -k1/J1 0 k1/J1 0 0 0;
```

```
      0 0 0 1 0 0;
```

```
      k1/(J2+m*r^2) 0 -(k1+k2*r^2)/(J2+m*r^2) -(fv*r^2+d3)/(J2+m*r^2) 0 d3/(J2+m*r^2);
```

```
      0 0 0 0 0 1;
```

```
      0 0 0 d3/J3 0 -d3/J3];
```

```
B = [0; 1/J1; 0; 0; 0; 0];
```

```
C = [1 0 0 0 0 0];
```

```
D = 0;
```

```
% Create the state-space system
```

```
sys_ss = ss(A, B, C, D);
```

```
%% Part A Variant Torque
```

```
clc;clear;
```

```
TR = [0 5];
```

```
X0 = [0;0;0;0;0;0];
```

```
k1=8;k2=5;fv=25;d3=2;T=5;m=15;J1=8;J2=10;J3=12;r=5;
```

```
for T=0:1:5
```

```
[t,y]= ode45(@(t,y)randFun(t,y,T,J1,J2,J3,m,r,fv,k1,k2,d3),TR,X0);
```

```
thGear=y(:,3);
```

```
omGear=y(:,4);
```

```
x=r*thGear;
```

```
v=r*omGear;
```

```
% Compute acceleration
```

```
a1 = gradient(v, t);
```

```
a2 = gradient(omGear, t);
```

```
subplot(2,3,4)
```

```
plot(t,thGear)
```

```
hold on
```

```
xlabel('time')
```

```
ylabel('theta-Gear')
```

```
subplot(2,3,5)
```

```
plot(t,omGear)
```

```
hold on
```

```
xlabel('time')
```

```
ylabel('Angular velocity-Gear')
```

```
subplot(2,3,1)
plot(t,x)
hold on
xlabel('time')
ylabel('displacement')
```

```
subplot(2,3,2)
plot(t,v)
hold on
xlabel('time')
ylabel('velocity')
```

```
subplot(2,3,3)
plot(t, a1)
hold on
xlabel('time')
ylabel('Acceleration-1')
```

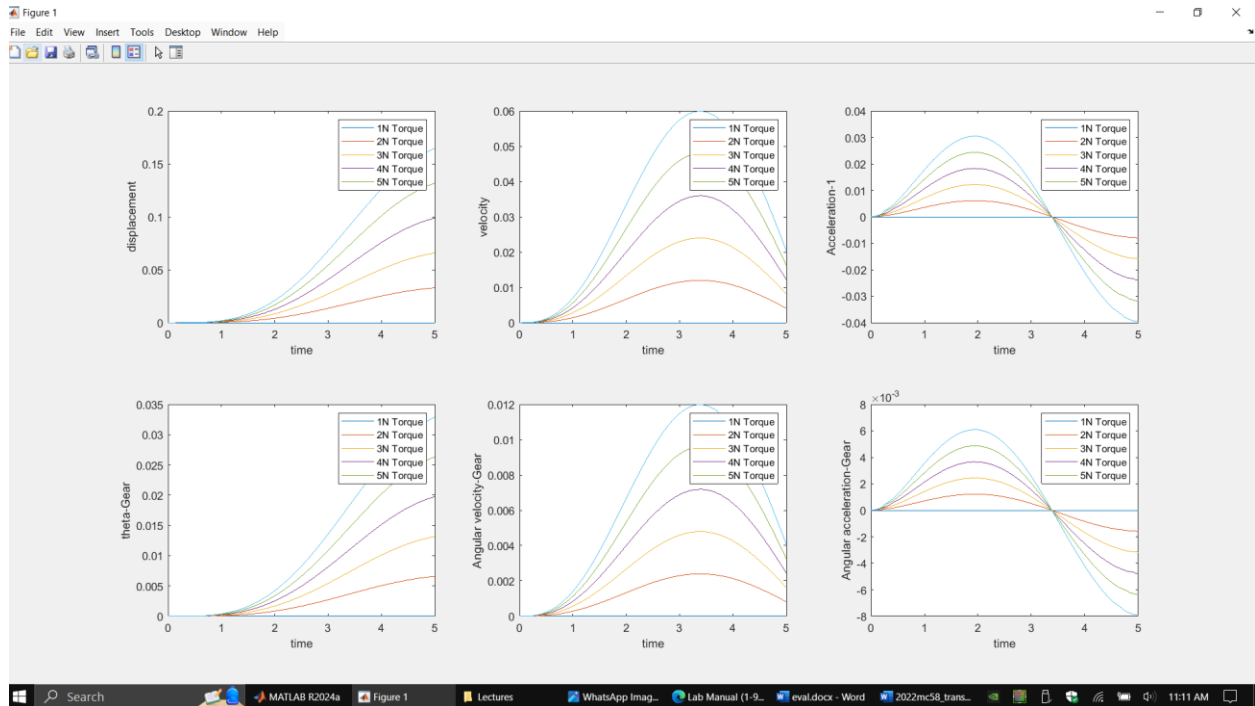
```
subplot(2,3,6)
plot(t, a2)
hold on
xlabel('time')
ylabel('Angular acceleration-Gear')
```

```
end
```

```
for i=1:6
```

```
subplot(2,3,i);legend('1N Torque', '2N Torque', '3N Torque', '4N Torque', '5N Torque')
```

end



------(Changing Radius)-----

```
clc;

clear;

TR = [0 50];

X0 = [0;0;0;0;0;0];

k1=8;k2=5;fv=25;d3=2;T=5;m=15;J1=8;J2=10;J3=12;r=5;

for r=1:1:8

    [t,y]=ode45(@(t,y)randFun(t,y,T,J1,J2,J3,m,r,fv,k1,k2,d3),TR,X0);

    thGear=y(:,3);

    omGear=y(:,4);

    x=r*thGear;
```

```
v=r*omGear;
```

```
% Compute acceleration
```

```
a1 = gradient(v, t);
```

```
a2 = gradient(omGear, t);
```

```
subplot(2,3,4)
```

```
plot(t,thGear)
```

```
hold on
```

```
xlabel('time')
```

```
ylabel('theta-Gear')
```

```
subplot(2,3,5)
```

```
plot(t,omGear)
```

```
hold on
```

```
xlabel('time')
```

```
ylabel('Angular velocity-Gear')
```

```
subplot(2,3,1)
```

```
plot(t,x)
```

```
hold on
```

```
xlabel('time')
```

```
ylabel('displacement')
```

```
subplot(2,3,2)
```

```
plot(t,v)
```

```
hold on
```

```
xlabel('time')
```

```
ylabel('velocity')
```

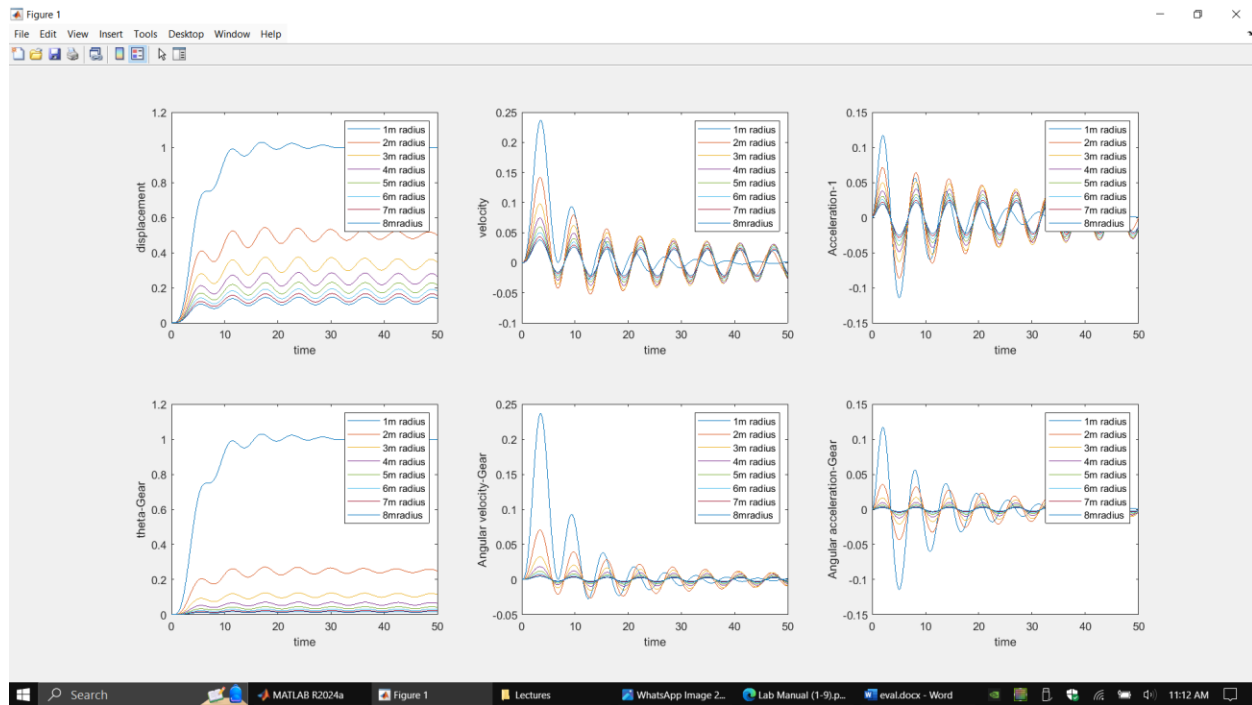


```
subplot(2,3,3)
plot(t, a1)
hold on
xlabel('time')
ylabel('Acceleration-1')

subplot(2,3,6)
plot(t, a2)
hold on
xlabel('time')
ylabel('Angular acceleration-Gear')

end

for i=1:6
subplot(2,3,i);legend('1m radius', '2m radius', '3m radius','4m radius', '5m radius', '6m radius', '7m
radius', '8mradius')
end
```



Fvs-----

```
clc;
```

```
clear;
```

```
TR = [0 50];
```

```
X0 = [0;0;0;0;0;0];
```

```
k1=8;k2=5;fv=25;d3=2;T=5;m=15;J1=8;J2=10;J3=12;r=5;
```

```
for fv=10:5:40
```

```
    [t,y]=ode45(@(t,y)randFun(t,y,T,J1,J2,J3,m,r,fv,k1,k2,d3),TR,X0);
```

```
    thGear=y(:,3);
```

```
    omGear=y(:,4);
```

```
    x=r*thGear;
```

```
    v=r*omGear;
```

```
    % Compute acceleration
```

```
a1 = gradient(v, t);
```

```
a2 = gradient(omGear, t);
```

```
subplot(2,3,4)
```

```
plot(t,thGear)
```

```
hold on
```

```
xlabel('time')
```

```
ylabel('theta-Gear')
```

```
subplot(2,3,5)
```

```
plot(t,omGear)
```

```
hold on
```

```
xlabel('time')
```

```
ylabel('Angular velocity-Gear')
```

```
subplot(2,3,1)
```

```
plot(t,x)
```

```
hold on
```

```
xlabel('time')
```

```
ylabel('displacement')
```

```
subplot(2,3,2)
```

```
plot(t,v)
```

```
hold on
```

```
xlabel('time')
```

```
ylabel('velocity')
```

```
subplot(2,3,3)
```

```
plot(t, a1)
```

```
hold on
```

```
xlabel('time')
```

```
ylabel('Acceleration-1')
```

```
subplot(2,3,6)
```

```
plot(t, a2)
```

```
hold on
```

```
xlabel('time')
```

```
ylabel('Angular acceleration-Gear')
```

```
end
```

```
for i=1:6
```

```
subplot(2,3,i);legend('fv 10', 'fv 15', 'fv 20', 'fv 20', 'fv 25', 'fv 30', 'fv 35', 'fv 40')
```

```
end
```

