```
% For constant tourque 5Nm
clc
clear
TR = [0 5]; % time RANGE
X0 = [0;0;0;0];%initial conditions
[t,z] = ode45(@func1, TR, X0);%calling thr ide solver to solve by function
%storing given array as vectors
theta1 = z(:, 1);
AngVel1 = z(:, 2);
theta2 = z(:, 3);
AngVel2 = z(:, 4);

%plotting the angular displacements and velocities
acc1 = diff(AngVel1);
acc2= diff(AngVel2);
plot(t,theta1,t,AngVel1,t,[0;acc1],t,theta2,t,AngVel2,t,[0;acc2]);
xlabel('time')
legend('Angular Displacement 1','Angular Velocity 1','Angulara acceleration 1','Angular Displacement 2','Angular Velocity 2','Angulara acceleration 2')
ylabel('position & Velocity')
title("m-file")
%function containing the differentialequations
function dx = func1(~, x)
% Values of Coefficients
J1=1; J2=10; D1=0.9; D2=0.02; k=3;T=5;

% State Equations
dx(1) = x(2);
dx(3) = x(4);
dx(2) = (T-D1*x(2)-k*x(1)+k*x(3))/J1;
dx(4) = (-k*x(3)-D2*x(4)+k*x(1))/J2;
dx = dx';
end
```

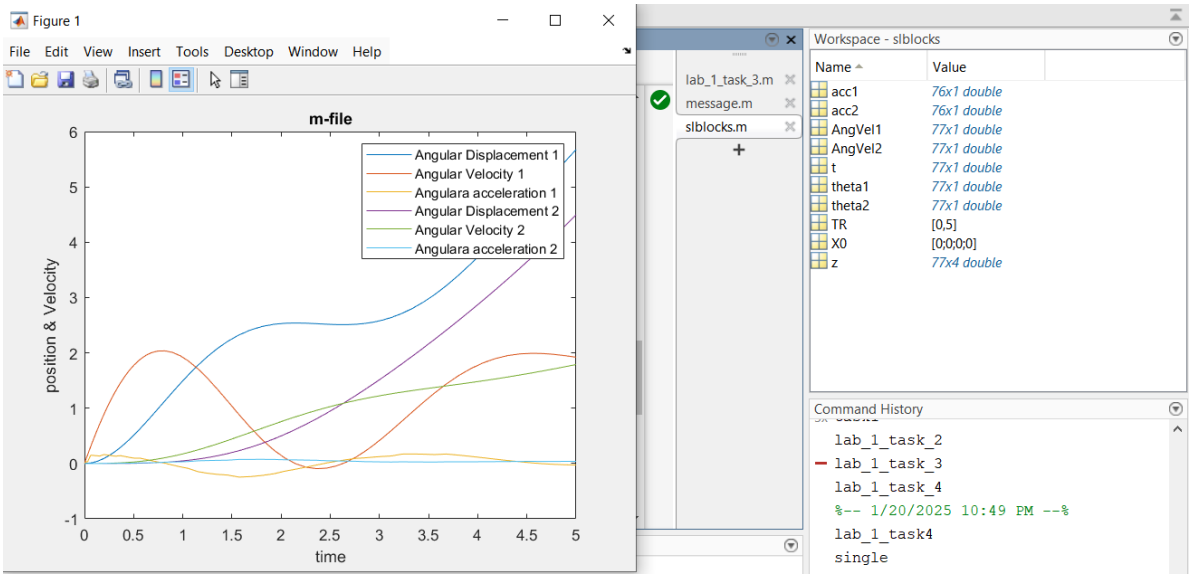
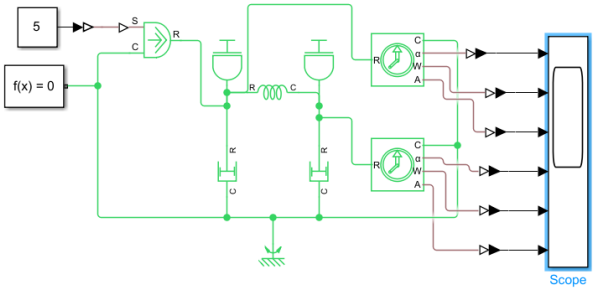
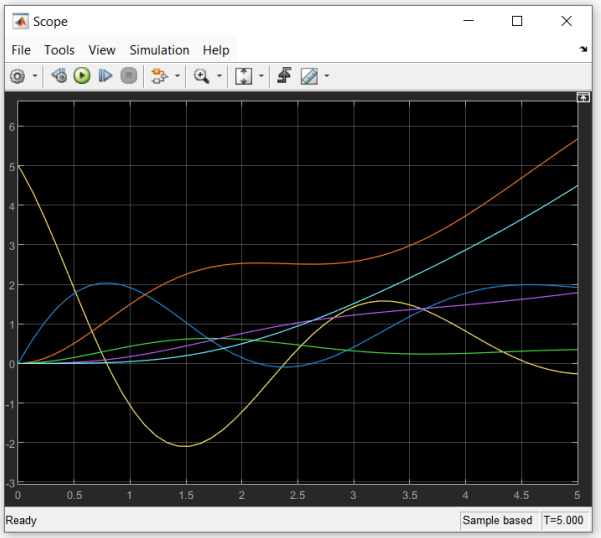


Figure 1
File Edit View Insert Tools Desktop Window Help
m-file
Angular Displacement 1
Angular Velocity 1
Angulara acceleration 1
Angular Displacement 2
Angular Velocity 2
Angulara acceleration 2
position & Velocity
time
lab_1_task_3.m
message.m
slblocks.m
Workspace - slblocks
Name
Value
acc1 76x1 double
acc2 76x1 double
AngVel1 77x1 double
AngVel2 77x1 double
t 77x1 double
theta1 77x1 double
theta2 77x1 double
TR [0,5]
X0 [0;0;0;0]
z 77x4 double
Command History
lab_1_task_2
lab_1_task_3
lab_1_task_4
%-- 1/20/2025 10:49 PM --%
lab_1_task4
single

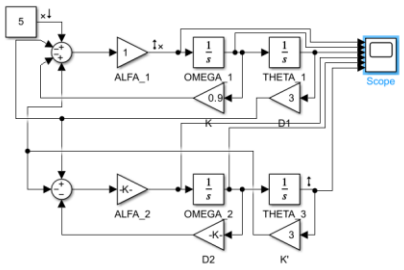


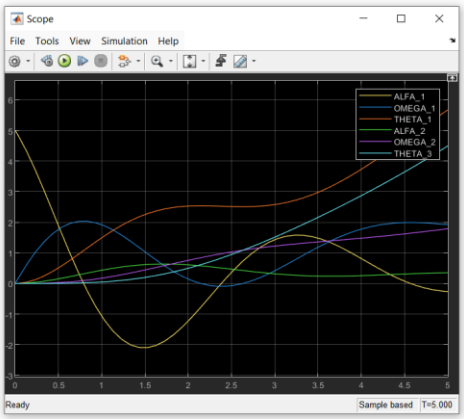


simulink

```
From input "Constant" to output "THETA_3":
                  0.3
-------------------------------------
s^4 + 0.902 s^3 + 3.002 s^2 + 0.006 s

A =
           OMEGA_1   OMEGA_2   THETA_1   THETA_3
  OMEGA_1     -0.9         0        -3         0
  OMEGA_2        0    -0.002       0.3         0
  THETA_1        1         0         0         0
  THETA_3        0         1         0         0
```



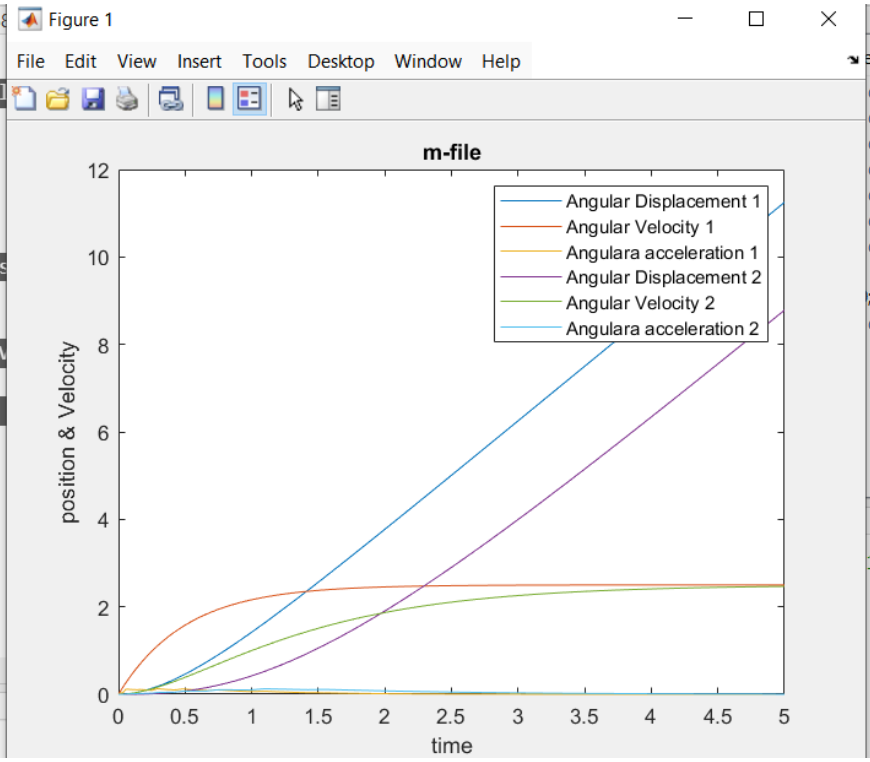



```
From input "Constant" to output "PS-Simulink Converter4":
                  0.3
-------------------------------------
s^4 + 0.902 s^3 + 3.302 s^2 + 0.276 s
```

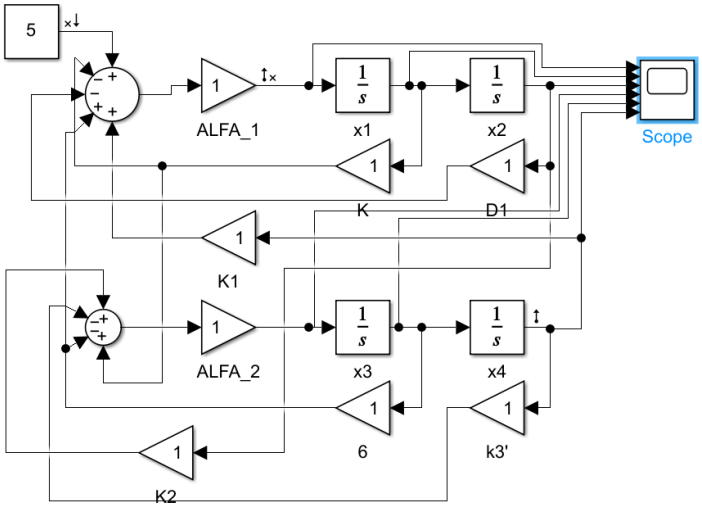
```
A =
                task1.Task1_  task1.Task1_  task1.Task1_  task1.Task1_
task1.Task1_          -0.9             0             0            -3
task1.Task1_             1             0             0             0
task1.Task1_             0             0        -0.002           0.3
task1.Task1_             1             0            -1             0
```

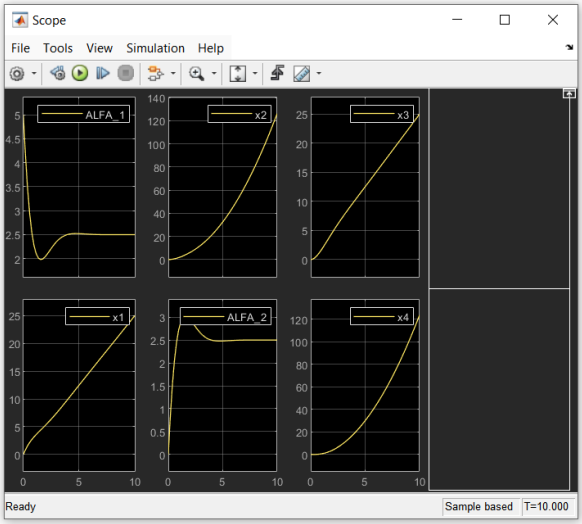
```
clc
clear
TR = [0 5]; % time RANGE
X0 = [0;0;0;0];%initial conditions
[t,z] = ode45(@func1, TR, X0);%calling thr ide solver to solve by function
%storing given array as vectors
theta1 = z(:, 1);
AngVel1 = z(:, 2);
theta2 = z(:, 3);
AngVel2 = z(:, 4);
%plotting the angular displacements and velocities
acc1 = diff(AngVel1);
acc2= diff(AngVel2);
plot(t,theta1,t,AngVel1,t,[0;acc1],t,theta2,t,AngVel2,t,[0;acc2]);
xlabel('time')
legend('Angular Displacement 1','Angular Velocity 1','Angulara acceleration 1','Angular Displacement 2','Angular Velocity 2','Angulara acceleration 2')
ylabel('position & Velocity')
title("m-file")
%function containing the differentialequationsa
function dx = func1(~, x)
% Values of Coefficients
% J1=1; J2=10; D1=0.9; D2=0.02; k=3
T=5;
%
% State Equations
dx(1) = x(2);
dx(3) = x(4);
dx(2) = (T-2*x(2)-x(1)+x(3)+x(4));
dx(4) = (x(2)-x(3)-2*x(4)+x(1));
dx = dx';
end
```

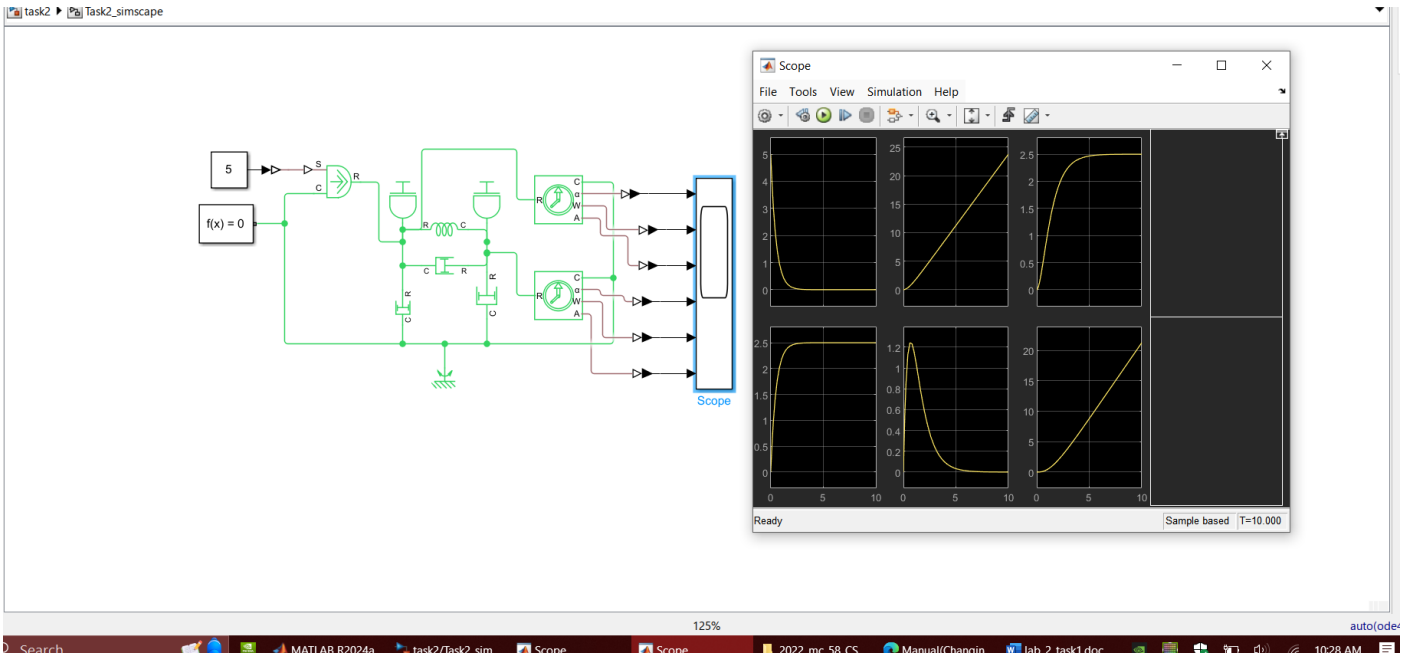
```
2022_MC_58\Semester6\Control_System_I\Lab\2022_MC_58
% time RANGE
;0];%initial conditions
45(@func1, TR, X0);%calling thr ide sol
ven array as vectors
:, 1);
(:, 2);
:, 3);
(:, 4);
he angular displacements and velocities
(AngVel1);
AngVel2);
a1,t,AngVel1,t,[0;acc1],t,theta2,t,AngV
e')
ular Displacement 1','Angular Velocity
ition & Velocity')
le")
ontaining the differentialequationsa
 = func1(~, x)
 Coefficients
10; D1=0.9; D2=0.02; k=3
```




```
double
double
double
double
double
double
double
;0]
double
10:49
```


5
ALFA_1
x1
x2
Scope
K
D1
K1
ALFA_2
x3
x4
6
k3'
K2


Scope
File Tools View Simulation Help
ALFA_1
x2
x3
x1
ALFA_2
x4
Ready
Sample based
T=10.000


task2
Task2_simscape
5
f(x) = 0
S
C
R
C
Q
W
A
Scope
Scope
File Tools View Simulation Help
Ready
Sample based
T=10.000
125%

```
clc;
TR=0:0.01:10;
x0=[0;0;0;0];
[t,x]=ode45(@Task3Fun,TR,x0);
th1=x(:,1);
om1=x(:,2);
alpha1=gradient(om1)./gradient(t);
th2=x(:,3);
om2=x(:,4);
alpha2=gradient(om2)./gradient(t);

subplot(2,3,1);
plot(t,th1);xlabel('time');ylabel('theta 1');
subplot(2,3,2);
plot(t,om1);xlabel('time');ylabel('omega 1');
subplot(2,3,3);
plot(t,alpha1);xlabel('time');ylabel('alpha 1')
subplot(2,3,4);
plot(t,th2);xlabel('time');ylabel('theta 2');
subplot(2,3,5);
plot(t,om2);xlabel('time');ylabel('omega 2');
subplot(2,3,6);
plot(t,alpha2);xlabel('time');ylabel('alpha 2')
%%%%%%%%%%%%%%%%%%%
function dy=Task3Fun(t,y)
   T=1;
   dy(1)=y(2);
   dy(2)=1/5*(y(4) + 9*y(3) - 9*y(2) - 9*y(1));
   dy(3)=y(4);
   dy(4)=1/3*(T+y(2) + 9*y(1) - y(4) - 12*y(3));
   dy=dy';
end
```

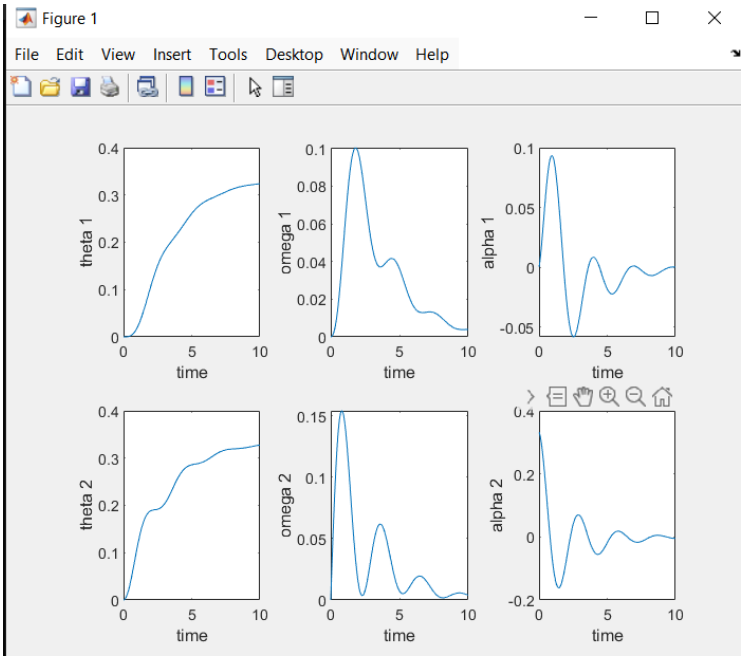
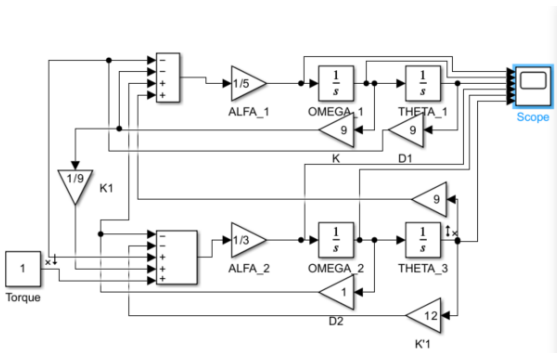
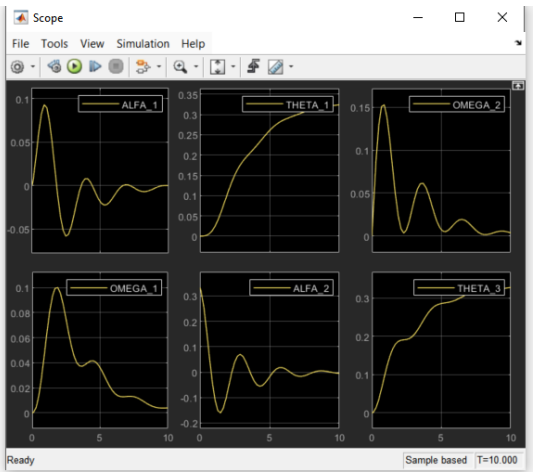


Figure 1
File Edit View Insert Tools Desktop Window Help
theta 1
omega 1
alpha 1
theta 2
omega 2
alpha 2
time

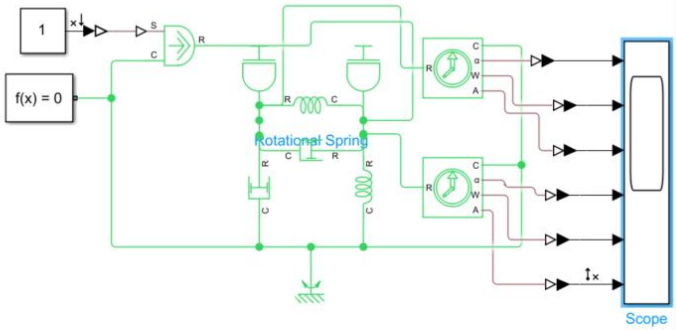


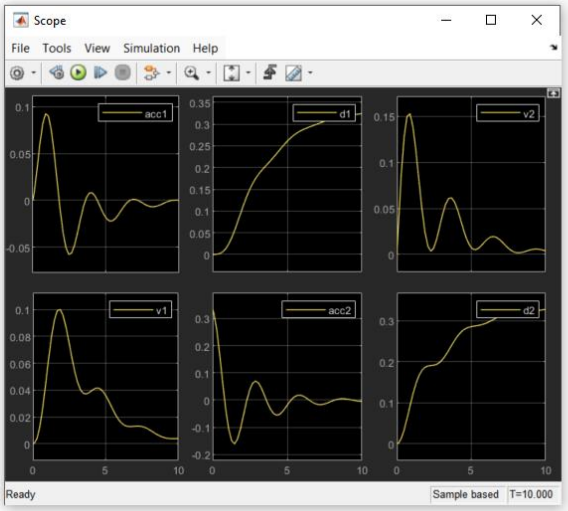



```
From input "Torque" to output "THETA_3":
          0.3333 s^2 + 0.6 s + 0.6
-----------------------------------------
s^4 + 2.133 s^3 + 2.333 s^2 - 9.171e-17 s
```

A =

	x1	x2	x3	x4
x1	-1.8	0.2	-1.8	0
x2	0.3333	-0.3333	3	0
x3	1	0	0	0
x4	0	1	0	0



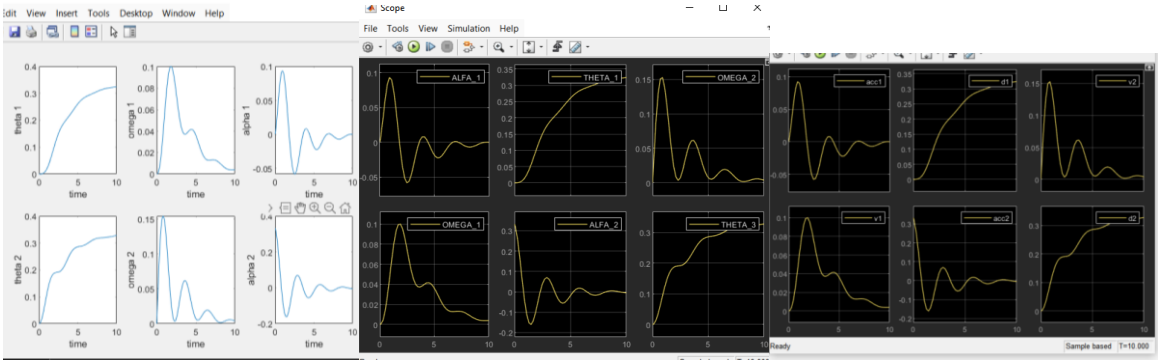


From input "u1" to output "y1":

$$\frac{0.3333\ s^2 + 0.6\ s + 0.6}{s^4 + 2.133\ s^3 + 6.333\ s^2 + 6.6\ s + 1.8}$$

A =

	x1	x2	x3	x4
x1	-1.8	0	0.2	-1.8
x2	1	0	0	0
x3	0.3333	-1	-0.3333	4
x4	1	0	-1	0


Edit View Insert Tools Desktop Window Help
theta 1
omega 1
alpha 1
theta 2
omega 2
alpha 2
time
Scope
File Tools View Simulation Help
ALFA_1
THETA_1
OMEGA_2
OMEGA_1
ALFA_2
THETA_3
acc1
d1
v2
v1
acc2
d2
Ready
Sample based T=10.000