Code :

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Final Project 1

clc;clear;

%% final

x = [5 5 5]';

totalStep = 5000;

x1arr = zeros(totalStep,1);

x2arr = x1arr;

x3arr = x1arr;

tarr = x1arr;

delt = 0.005;

x1arr(1) = x(1);

x2arr(1) = x(2);

x3arr(1) = x(3);

syms s;

a1=-80;

a2=-66;

a3=-15;

A = [0 1 0;

0 0 1;

a1 a2 a3];

s=double(solve(s^3-a3\*s^2-a2\*s-a1))

for i=1:totalStep

x\_dot = zeros(size(x));

xN = x\_dot;

x\_dot = A\*x;

xN = x + x\_dot\*delt;

x1arr(i+1) = xN(1);

x2arr(i+1) = xN(2);

x3arr(i+1) = xN(3);

tarr(i+1) = delt\*i; %®É¶¡¸ê®Æ

x = xN;

end

figure(1);

plot3(x1arr,x2arr,x3arr,'b');

xlabel('x1');ylabel('x2');zlabel('x3')

figure(2);

plot(tarr,x1arr,'r',tarr,x2arr,'g',tarr,x3arr,'b');

xlabel('Time');ylabel('X');

legend('x1','x2','x3')

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Final Project 2

clc;clear;close all;

%% final

x = [2 -6 -5]';

totalStep = 5000;

x1arr = zeros(totalStep,1);

x2arr = x1arr;

x3arr = x1arr;

tarr = x1arr;

delt = 0.005;

x1arr(1) = x(1);

x2arr(1) = x(2);

x3arr(1) = x(3);

a=1;b=4;c=1;

S(1) = a\*x(1)+b\*x(2)+c\*x(3);

for i=1:totalStep

S(i+1) = a\*x(1)+b\*x(2)+c\*x(3);

k = 8\*S(i+1);

u = -1\*( a\*(x(2)+x(1)-x(3)+sin(x(1)-x(3))) + b\*(x(3)+(x(1)-x(3))^2) + c\*(sin(x(1)-x(3))) )-1\*k;

A = [1 1 -1;

x(1)-2\*x(3) 0 1+x(3);

0 0 0];

x\_dot = zeros(size(x));

xN = x\_dot;

B\_sin = [1;0;1];

B\_u = [0;0;1];

x\_dot = A\*x + B\_sin\*sin(x(1)-x(3)) + B\_u\*u;

xN = x + x\_dot\*delt;

x1arr(i+1) = xN(1);

x2arr(i+1) = xN(2);

x3arr(i+1) = xN(3);

tarr(i+1) = delt\*i;

x = xN;

end

figure(1);

plot3(x1arr,x2arr,x3arr,'b');

xlabel('x1');ylabel('x2');zlabel('x3');hold on;

plot3(x1arr(1),x2arr(1),x3arr(1),'o',x1arr(totalStep+1),x2arr(totalStep+1),x3arr(totalStep+1),'x')

figure(2);

plot(tarr,x1arr,'r',tarr,x2arr,'g',tarr,x3arr,'b',tarr,S,'y');%

%plot(tarr(1:30),x1arr(1:30),'r',tarr(1:30),x2arr(1:30),'g',tarr(1:30),x3arr(1:30),'b');

xlabel('Time');ylabel('X');

legend('x1','x2','x3','S')

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Final Project 3

clc;clear;

%% final

%MRAC

delt = 0.01;

totTime = 130;

totalStep = totTime/delt ;

tarr= [0 : 1 : totalStep]\*delt;

x = [0;0;0];

xm = [0;0;0];

%

a1=-12; a2=-4; a3=-3;

%pole assignment ¿ï¥Îpole:-2 -5 -8

am1=-80; am2=-66; am3=-15;

bm = 1;b = 1;

A = [ 0 1 0;

0 0 1;

a1 a2 a3];

Am = [ 0 1 0;

0 0 1;

am1 am2 am3];

B = [0;0;b];

Bm = [0;0;bm];

gama1 = 1;

gama2 = 0.5;

gama3 = 4;

gama4 = 5;

Q=[0.001 0 0;0 0.001 0;0 0 2000];

P = lyap(Am,Q)

theta(:,1)=[0;0;0;0];

xarr1 = zeros(totalStep+1,1);xarr2 = xarr1;xarr3 = xarr1;

xmarr1 = zeros(totalStep+1,1);xmarr2 = xmarr1;xmarr3 = xmarr1;

xarr1(1) = x(1);xarr2(1) = x(2);

x\_1 = xarr1(1);x\_2 = xarr2(1);x\_3 = xarr3(1);

xmarr1(1) = xm(1);xmarr2(1) = xm(2);

xm\_1 = xmarr1(1);xm\_2 = xmarr2(1);xm\_3 = xmarr3(1);

for i=1:totalStep

k = i;

%r(k) = 1;

r(k)= 1;

u(k) = theta(1,k)\*r(k) + theta(2,k)\*x\_1 + theta(3,k)\*x\_2 + theta(4,k)\*x\_3;

%Xm (Mode)

xm\_dot = Am\*xm + Bm\*r(k);

xmN = xm + xm\_dot\*delt;

xmarr1(i+1) = xmN(1);xmarr2(i+1) = xmN(2);xmarr3(i+1) = xmN(3);

xm = xmN;

xm\_1 = xmN(1);xm\_2 = xmN(2);xm\_3 = xmN(3);

%X

x\_dot = A\*x + B\*u(k);

xN = x + x\_dot\*delt;

xarr1(i+1) = xN(1);xarr2(i+1) = xN(2);xarr3(i+1) = xN(3);

x = xN;

x\_1 = xN(1);x\_2 = xN(2);x\_3 = xN(3);

%E

e\_1 = xm\_1-x\_1;

e\_2 = xm\_2-x\_2;

e\_3 = xm\_3-x\_3;

e(:,i)=[e\_1;e\_2;e\_3];

%cal

zeta = 0.5\*( P(1,3)\*e\_1+P(2,3)\*e\_2+P(3,3)\*e\_3 );

Z(i) = zeta;

theta(1,k+1) = theta(1,k) + delt\*(zeta\*r(k))/(b\*gama1);

theta(2,k+1) = theta(2,k) + delt\*(zeta\*x\_1)/(b\*gama2);

theta(3,k+1) = theta(3,k) + delt\*(zeta\*x\_2)/(b\*gama3);

theta(4,k+1) = theta(4,k) + delt\*(zeta\*x\_3)/(b\*gama4);

end

figure(1)

hold on;

subplot(3,1,1)

plot(tarr,xarr1,'b',tarr,xmarr1,'r')

xlabel('x\_1');ylabel('x\_m\_1');

legend('x','xm')

subplot(3,1,2)

plot(tarr,xarr2,'b',tarr,xmarr2,'r')

xlabel('x\_2');ylabel('x\_m\_2');

legend('x','xm')

subplot(3,1,3)

plot(tarr,xarr3,'b',tarr,xmarr3,'r')

xlabel('x\_3');ylabel('x\_m\_3');

legend('x','xm')

figure(2)

hold on;

plot(tarr,theta(4,:),'r');

plot(tarr,theta(3,:),'g');

plot(tarr,theta(2,:),'b');

plot(tarr,theta(1,:),'y');

xlabel('Time');ylabel('theta');

title('Q\_3\_3=2000')

legend('theta4','theta3','theta2','theta1')

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Final Project 4

clc;clear;

%% final

t = 0.01:0.01:10;

% Gp sys

G\_num = [0.5 3];

G\_den = [1 2 0];

G\_sys = tf(G\_num,G\_den);

% Controller sys

C\_num = [20 1];

C\_den = [1 1];

C\_sys = tf(C\_num,C\_den);

% G\_tilta sys

g\_num = [1 1];

g\_den = [20 1];

g\_sys = tf(g\_num,g\_den);

% delay sys

de\_num = [-0.001 1];

de\_den = [0.001 1];

de\_sys = tf(de\_num,de\_den);

d = 0.1\*( tf([cos(2.7)\*10],[1 0 100]) + tf([sin(2.7)\*1 0],[1 0 100]));

R = tf([1],[1 0]);

fb\_sys = (C\_sys\*G\_sys + (1-C\_sys\*g\_sys\*de\_sys)\*d/R) / (1+(G\_sys-g\_sys\*de\_sys)\*C\_sys);

step(fb\_sys,10);

Simulink:

