**Open loop response:**

clc;

clear all;

close;

num=1;

den1=[1 4 13] %%for -2+3i & -2-3i

open\_sys1=tf(num,den1);

a=step(open\_sys1,0:0.01:5);

x=0:0.01:5;

plot(x,a,'b');

grid on;

title('step response fo open loop sytem');

stepinfo(open\_sys1)

Result:

den1 =

1 4 13

ans =

RiseTime: 0.4854

SettlingTime: 1.6205

SettlingMin: 0.0713

SettlingMax: 0.0864

Overshoot: 12.3046

Undershoot: 0

Peak: 0.0864

PeakTime: 1.0362



**Horizontal Pole Change:**

clc;

clear all;

close;

num=1;

den1=[1 4 13] %for -2+3i & -3-3i

open\_sys1=tf(num,den1);

a=step(open\_sys1,0:0.01:5);

den2=[1 9 25] %for -4+3i & -4-3i

open\_sys2=tf(num,den2);

b=step(open\_sys2,0:0.01:5);

den3=[1 12 45] %for -6+3i & -6-3i

open\_sys3=tf(num,den3);

c=step(open\_sys3,0:0.01:5);

x=0:0.01:5;

plot(x,a,'b',x,b,'g',x,c,'k');

grid on;

title('step response fo open loop sytem');

stepinfo(open\_sys1)

stepinfo(open\_sys2)

stepinfo(open\_sys1)

**Result:**  
den1 =

1 4 13

den2 =

1 9 25

den3 =

1 12 45

ans =

RiseTime: 0.4854

SettlingTime: 1.6205

SettlingMin: 0.0713

SettlingMax: 0.0864

Overshoot: 12.3046

Undershoot: 0

Peak: 0.0864

PeakTime: 1.0362



**Vertical Change:**

clc;

clear all;

close;

num=1;

den1=[1 4 13] %for -2+4i & -2-3i

open\_sys1=tf(num,den1);

a=step(open\_sys1,0:0.01:5);

den2=[1 4 53] %for -2+7i & -2-7i

open\_sys2=tf(num,den2);

b=step(open\_sys2,0:0.01:5);

den3=[1 4 85] %for -2+9i & -2-9i

open\_sys3=tf(num,den3);

c=step(open\_sys3,0:0.01:5);

x=0:0.01:5;

plot(x,a,'b',x,b,'g',x,c,'k');

grid on;

title('step response fo open loop sytem');

stepinfo(open\_sys1)

stepinfo(open\_sys2)

stepinfo(open\_sys1)

**Result:**

den1 =

1 4 13

den2 =

1 4 53

den3 =

1 4 85

ans =

RiseTime: 0.4854

SettlingTime: 1.6205

SettlingMin: 0.0713

SettlingMax: 0.0864

Overshoot: 12.3046

Undershoot: 0

Peak: 0.0864

PeakTime: 1.0362

ans =

RiseTime: 0.1779

SettlingTime: 1.9075

SettlingMin: 0.0157

SettlingMax: 0.0265

Overshoot: 40.6146

Undershoot: 0

Peak: 0.0265

PeakTime: 0.4375

ans =

RiseTime: 0.4854

SettlingTime: 1.6205

SettlingMin: 0.0713

SettlingMax: 0.0864

Overshoot: 12.3046

Undershoot: 0

Peak: 0.0864

PeakTime: 1.0362



**Angle Change:**

clc;

clear all;

close;

num=1;

den1=[1 6 25] %for -2+3i & -2-3i

open\_sys1=tf(num,den1);

a=step(open\_sys1,0:0.01:5);

den2=[1 6 58] %for -4+6i & -4-6i

open\_sys2=tf(num,den2);

b=step(open\_sys2,0:0.01:5);

den3=[1 6 64] %for -6+9i & -6-9i

open\_sys3=tf(num,den3);

c=step(open\_sys3,0:0.01:5);

x=0:0.01:5;

plot(x,a,'b',x,b,'g',x,c,'k');

grid on;

title('step response fo open loop sytem');

stepinfo(open\_sys1)

stepinfo(open\_sys2)

stepinfo(open\_sys1)

**Result:**

den1 =

1 6 25

den2 =

1 6 58

den3 =

1 6 64

ans =

RiseTime: 0.3711

SettlingTime: 1.1887

SettlingMin: 0.0363

SettlingMax: 0.0438

Overshoot: 9.4773

Undershoot: 0

Peak: 0.0438

PeakTime: 0.7829

ans =

RiseTime: 0.1912

SettlingTime: 1.1043

SettlingMin: 0.0160

SettlingMax: 0.0217

Overshoot: 26.0076

Undershoot: 0

Peak: 0.0217

PeakTime: 0.4452

ans =

RiseTime: 0.3711

SettlingTime: 1.1887

SettlingMin: 0.0363

SettlingMax: 0.0438

Overshoot: 9.4773

Undershoot: 0

Peak: 0.0438

PeakTime: 0.7829

