自动控制原理实验三

例题

1、常规根轨迹

```
1  >> num= 1;
2  >> den = [conv([1,4],conv([1 -2+4*i],[1 -2-4*i])),0]
3  den =
4       1    0    4    80    0
5  >> G=tf(num, den)
6  G =
7            1
8    ------------------
9    s^4 + 4 s^2 + 80 s
10 Continuous-time transfer function.
11 >> rlocus(G)
12 >> [r,k] = rlocus(G);
```

2、指定点的开环增益
(1) T = 2，zeta =0.2 wn=1时的根轨迹

```
1  >> wn=1;
2  >> zeta=0.4;
3  >> T=2;
4  >> w=logspace(-1,2);
5  >> G1=tf(wn^2,[1 2*zeta*wn,wn^2])
6  G1 =
7            1
8    ---------------
9    s^2 + 0.8 s + 1
10 Continuous-time transfer function.
11 >> G2=tf([T,1],1);
12 >> G=G1*G2;
13 >> rlocus(G)
```

(2) 增加一个极点p=−5，零点z=−2,绘制根轨迹

```
1  >> GG1 = G*tf(1,[1 5])
2  GG1 =
3              2 s + 1
4    -----------------------
5    s^3 + 5.8 s^2 + 5 s + 5
6  Continuous-time transfer function.
7  >> GG2 = GG1*tf([1 2],1)
8  GG2 =
```

```
9      2 s^2 + 5 s + 2
10   ----------------------
11   s^3 + 5.8 s^2 + 5 s + 5
12 Continuous-time transfer function.
13 >> rlocus(GG2)
```

（3）用鼠标点击获得根轨迹上点的增益和极点

```
1 Select a point in the graphics window
2 selected_point =
3   -7.2614 + 0.0695i
4 k =
5     3.2907
6 p =
7   -7.2625 + 0.0000i
8   -0.9141 + 0.8713i
9   -0.9141 - 0.8713i
```

练习

1、求开环零极点以及根轨迹

```
1 >> num = 1;
2 >> den = [1 5 8 6 0];
3 >> [z p k] = tf2zp(num,den)
4 z =
5   空的 0×1 double 列向量
6 p =
7    0.0000 + 0.0000i
8   -3.0000 + 0.0000i
9   -1.0000 + 1.0000i
10   -1.0000 - 1.0000i
11 k =
12     1
```

> 引用

```
1 >> q = [1 2 2];
2 >> p = [1 2 5];
3 >> den = conv(p,q)
4 den =
5     1    4    11    14    10
6 >> num = 1;
7 >> G = tf(num,den)
8 G =
9               1
10   -------------------------------
11   s^4 + 4 s^3 + 11 s^2 + 14 s + 10
12 Continuous-time transfer function.
13 >> rlocus(G)
```

3、根轨迹图

```
1 >> G1 = tf(0.5,[0.5 1 0]);
```

```matlab
>> G11 = feedback(G1,2,-1)
G11 =
        0.5
   ---------------
   0.5 s^2 + s + 1
Continuous-time transfer function.
>> G2 = tf(1,[1 0])
G2 =
   1
   -
   s
Continuous-time transfer function.
>> G22 = G2*G11
G22 =
          0.5
   -----------------
   0.5 s^3 + s^2 + s
Continuous-time transfer function.
>> % 由此得到前向回路的传递函数tf(1,[1 2 2 0])
>> GG = tf(1,[1 2 2 0])
GG =
          1
   -----------------
   s^3 + 2 s^2 + 2 s
Continuous-time transfer function.
>> rlocus(GG)
```

4、开环增益

```matlab
>> G = tf([0.25 1],[0.5 1 0]);
>> rlocus(G)
```

5、根轨迹

```matlab
>> G = tf([1 0.1],[1 0.01 0 0]);
>> H = tf([0.6,1],1)
H =
   0.6 s + 1
Continuous-time transfer function.
>> GG = G*H
GG =
   0.6 s^2 + 1.06 s + 0.1
   ---------------------
        s^3 + 0.01 s^2
Continuous-time transfer function.
>> rlocus(GG)
```

6、正反馈系统的根轨迹

```matlab
>> G1 = tf([-1 -2],[conv([1 3],[1 2 2])])
G1 =
            -s - 2
   --------------------
   s^3 + 5 s^2 + 8 s + 6
```

```
6  Continuous-time transfer function.
7  >> rlocus(G1)
```

7、

```
1   >> num =1;
2   >> den = [conv([1 1],[1 1]),conv([1 4],[1 4])]
3   den =
4        1     2     1     1     8     16
5   >> G = tf(-num,den)
6   G =
7                        -1
8      --------------------------------
9      s^5 + 2 s^4 + s^3 + s^2 + 8 s + 16
10  Continuous-time transfer function>> rlocus(G)
```

8、

```
1   >> num = 1;
2   >> den = [4 4 1 0];
3   >> G = tf(num,den)
4   G =
5             1
6      -----------------
7      4 s^3 + 4 s^2 + s
8   Continuous-time transfer function.
9   >> rlocus(G)
```

9、根轨迹

```
1   >> G = tf(num,den)
2   G =
3           s
4      ------------
5      s^2 + s + 10
6   Continuous-time transfer function.
7   >> rlocus(G)
```

10、

```
1   >> num = [1 1];
2   >> den = [0.1 1 0 0];
3   >> G = tf(num,den)
4   G =
5          s + 1
6      ------------
7      0.1 s^3 + s^2
8   Continuous-time transfer function.
9   >> rlocus(G)
```