HW3 106061226 施竣笙

CP3.1

(a)

```
sys_ss =

  A =
       x1
   x1  -10

  B =
       u1
   x1   1

  C =
       x1
   y1   1

  D =
       u1
   y1   0
```

(b)

```
sys_ss =

  A =
        x1    x2
   x1   -8  -2.5
   x2    2     0

  B =
       u1
   x1   2
   x2   0

  C =
        x1    x2
   y1 -1.5  -0.5

  D =
       u1
   y1   1
```

(c)

```
sys_ss =

  A =
        x1    x2    x3
   x1   -3  -1.5    -1
   x2    2     0     0
   x3    0   0.5     0

  B =
       u1
   x1   1
   x2   0
   x3   0

  C =
        x1    x2    x3
   y1    0   0.5     1

  D =
       u1
   y1   0
```

CP3.2

(a)

```
sys_tf =

        1
  -------------
  s^2 - 8 s - 2
```

(b)

```
sys_tf =

          6 s - 10
  -----------------------
  s^3 + 6 s^2 - 21 s + 10
```

(c)

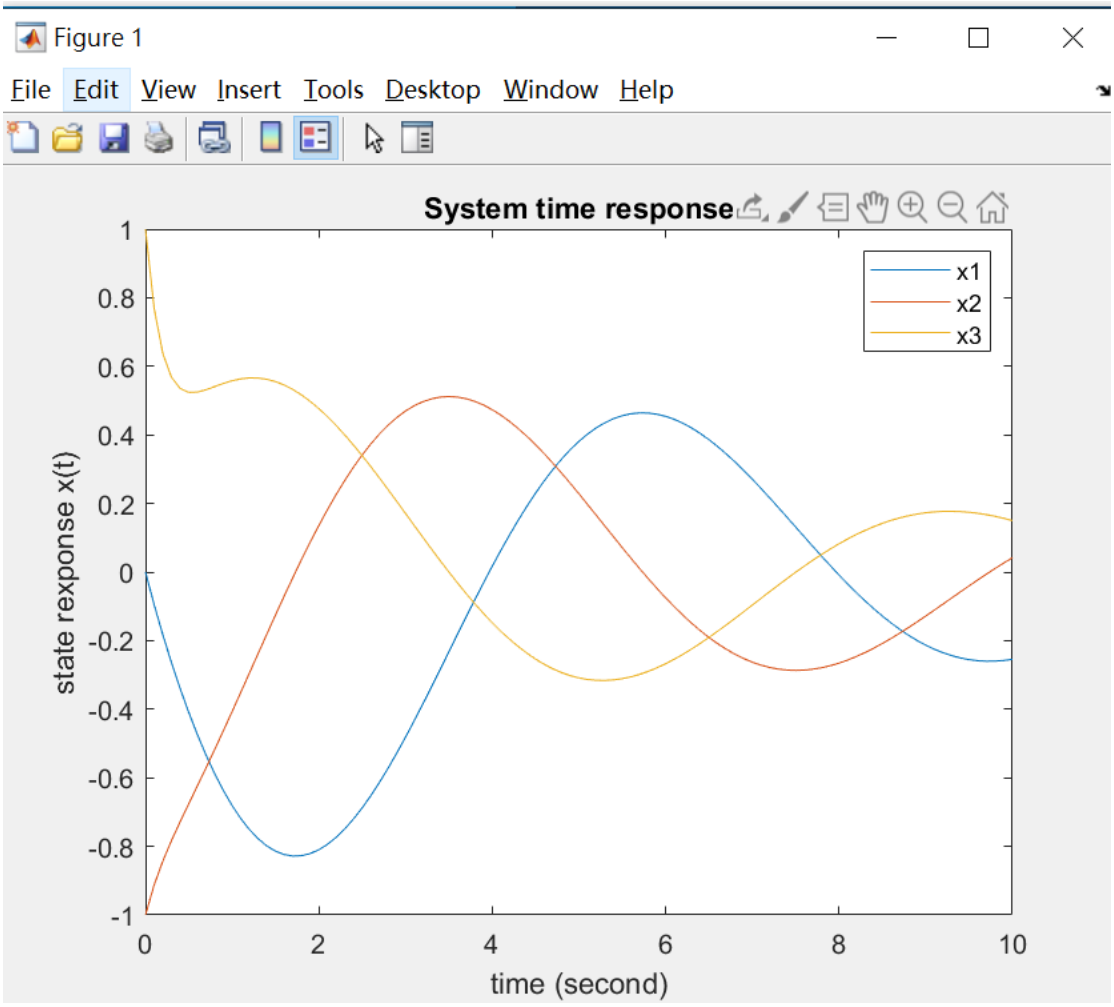
```
sys_tf =

       s - 2
  -------------
  s^2 + 2 s + 1
```

CP3.4

(a)

```
sys_tf =

             1
  --------------------
  s^3 + 5 s^2 + 2 s + 3
```

(b)



(c)

System response from (b)

```
xf_sim =

   -0.2545
    0.0418
    0.1500
```

System response using ‘expm’ function

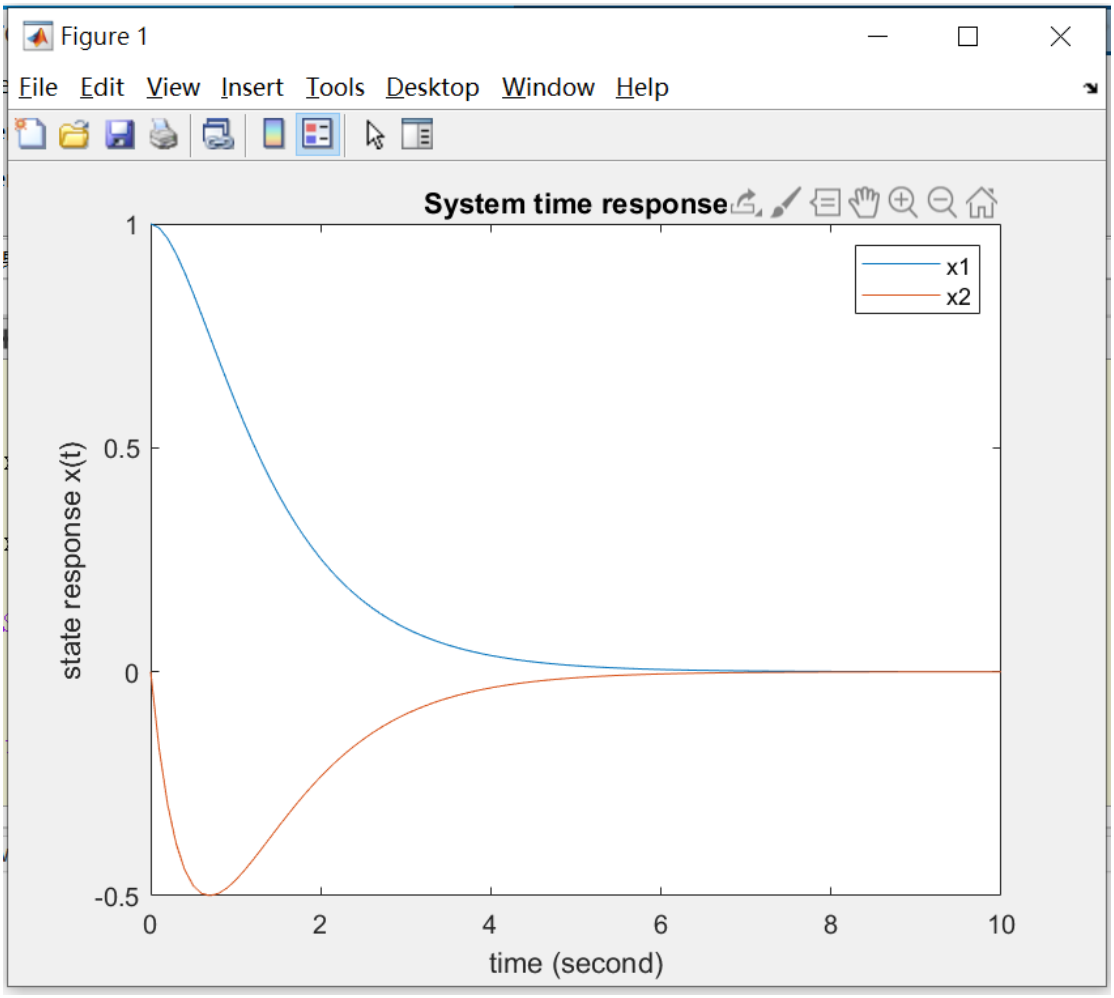
```
xf_phi =

   -0.2545
    0.0418
    0.1500
```

Comment:

The result are the same.

CP3.7

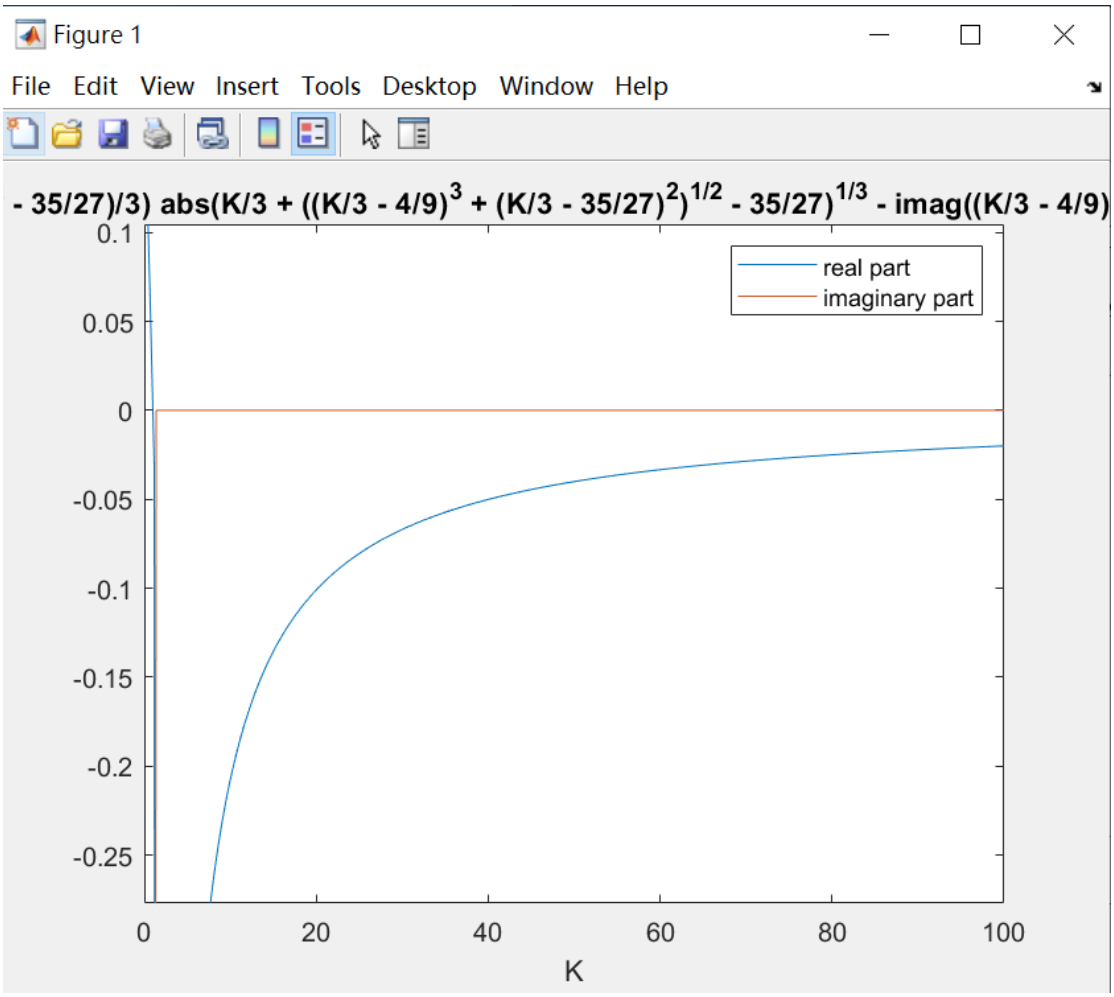
Using the lsim function to compute the zero input response



CP3.8

透過尋找 A matrix 的 eigenvalue(3 階->3 個 eigenvalue)判斷這幾個 eigenvalue 是否在左半平面(虛部不管，實部<0)

第一個 root:



第二個 root:

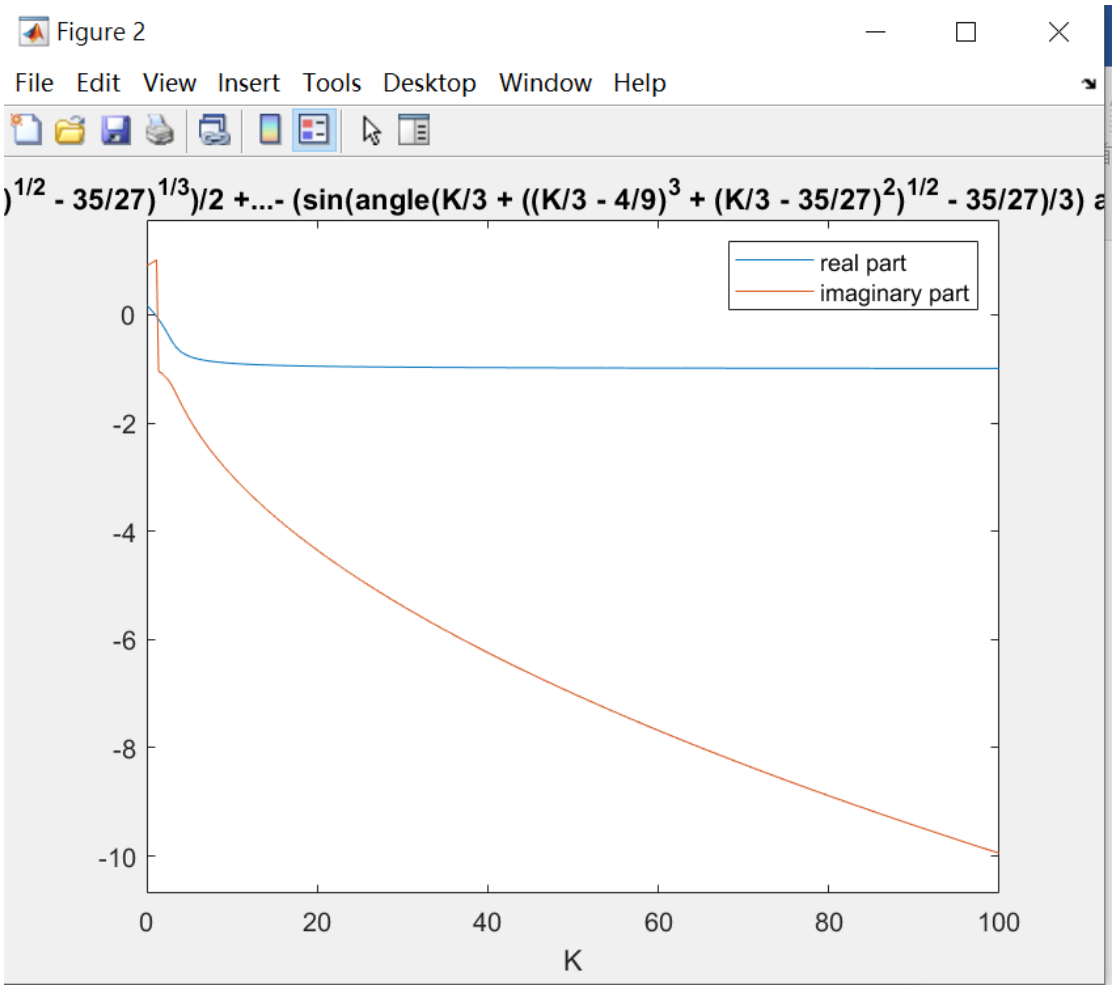


Figure 2
File Edit View Insert Tools Desktop Window Help
)^1/2 - 35/27)^1/3)/2 +...- (sin(angle(K/3 + ((K/3 - 4/9)^3 + (K/3 - 35/27)^2)^1/2 - 35/27)/3) a
real part
imaginary part
0
-2
-4
-6
-8
-10
0
20
40
60
80
100
K

第三個 root:

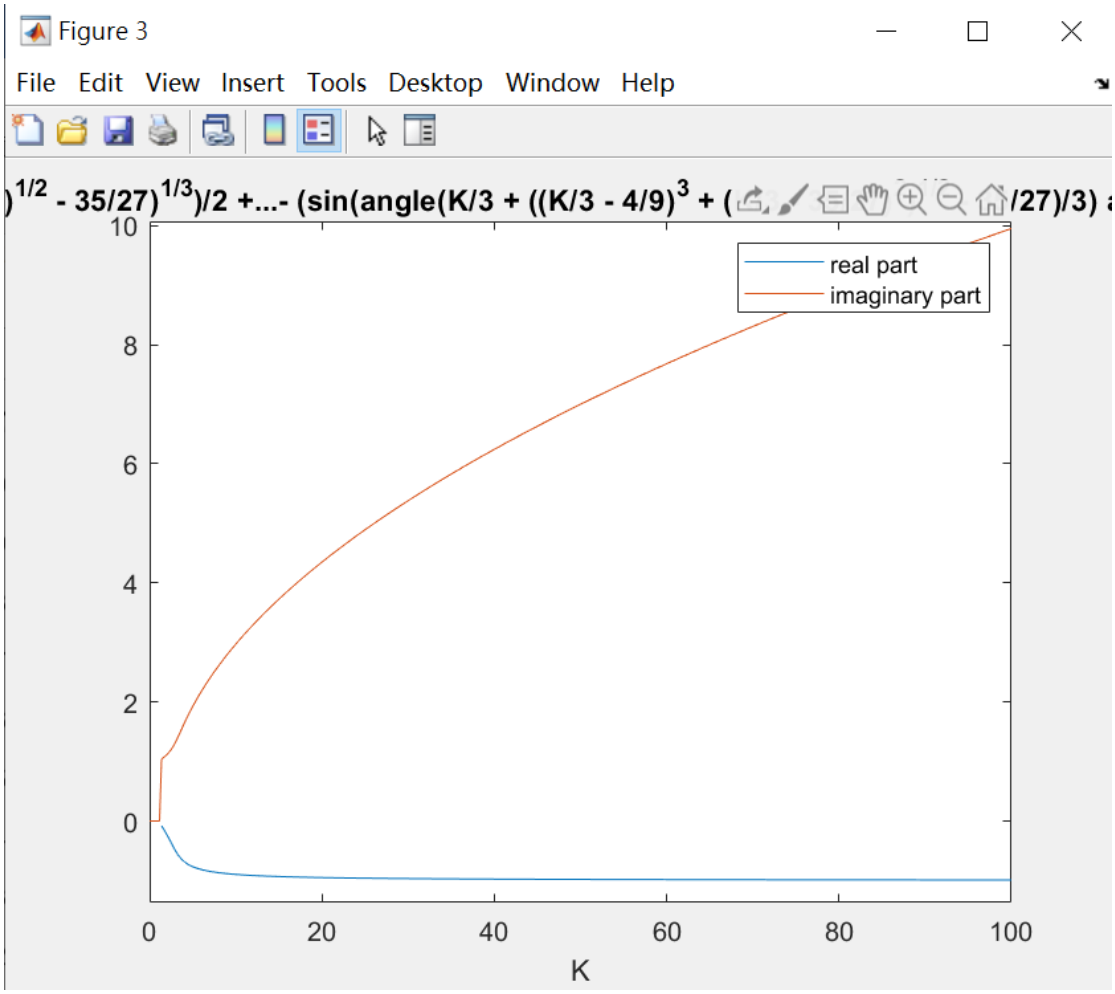
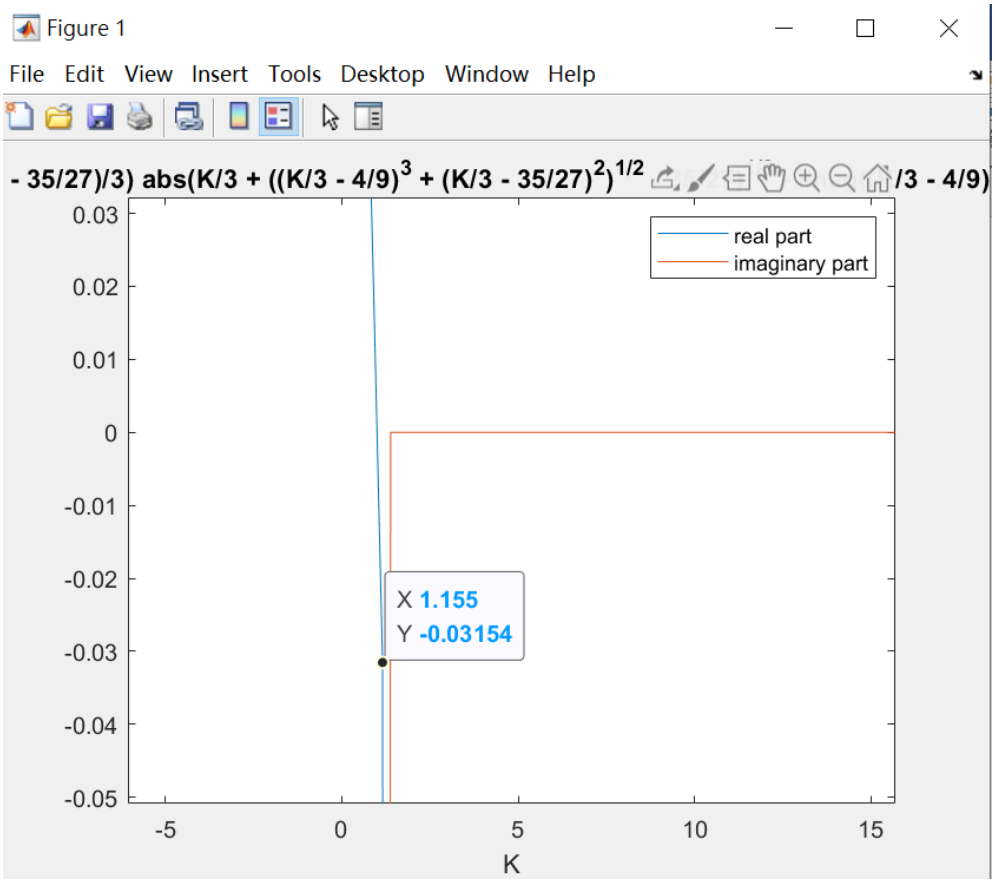
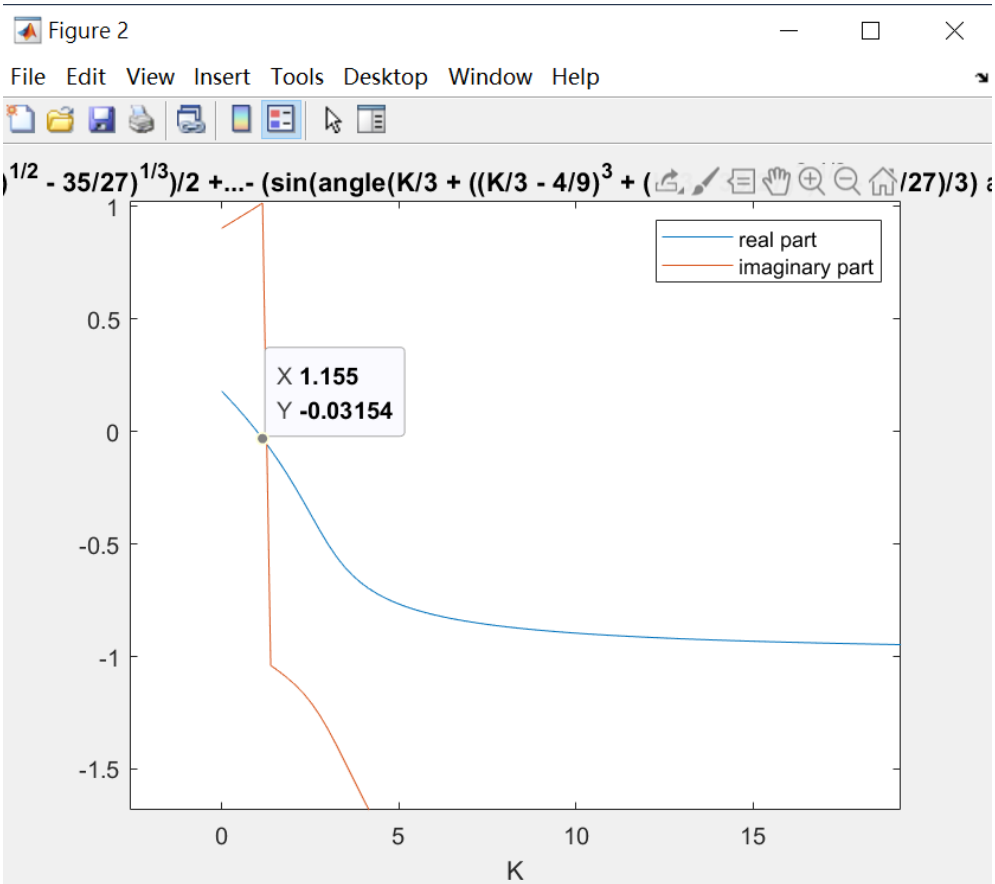
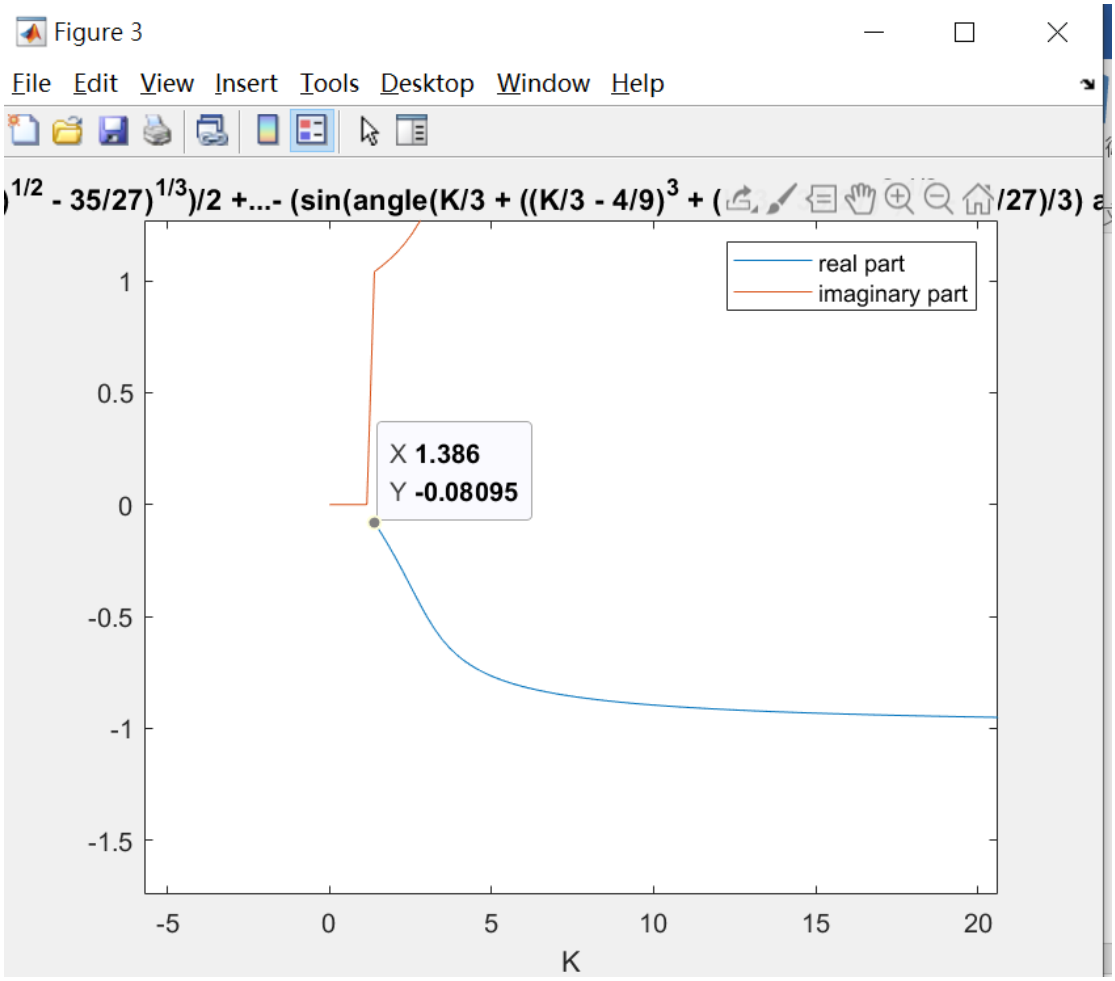


Figure 3
File Edit View Insert Tools Desktop Window Help
)^1/2 - 35/27)^1/3)/2 +...- (sin(angle(K/3 + ((K/3 - 4/9)^3 + (
/27)/3)
real part
imaginary part
10
8
6
4
2
0
0
20
40
60
80
100
K

接下來就找到一個 K 值讓 3 個 roots 的實部皆小於 0







Comment:雖然此圖顯示 1.386，但是還有一部分沒有 plot 出來，推測是因為

結論:

由上面 3 圖可以得知，在 K>1.15(約等於 1)後實部就皆小於 0

所以，1<K<=100 會限制全部特徵值落在左半平面。