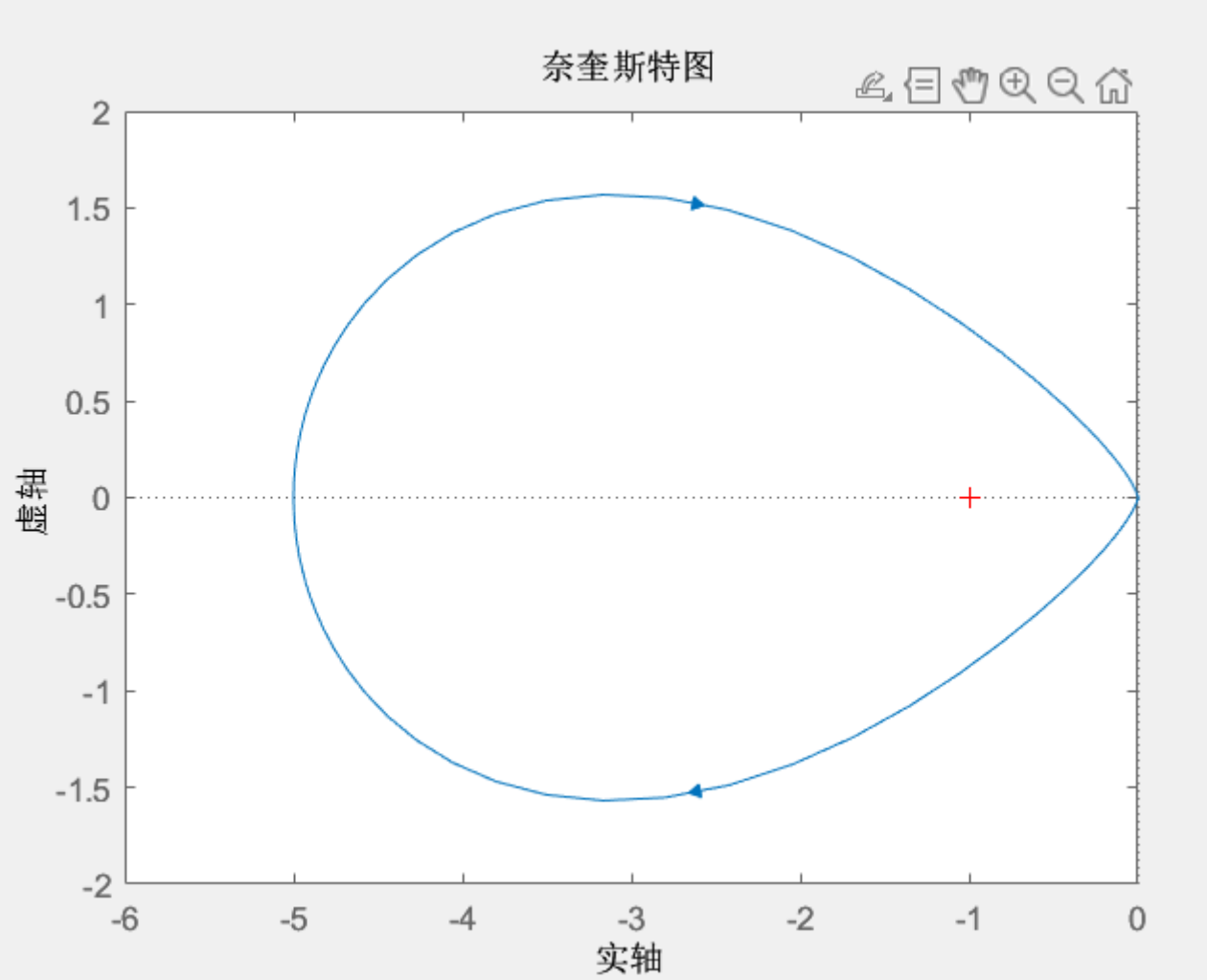
MATLAB实验报告

实验内容4

exp1

Nyquist曲线

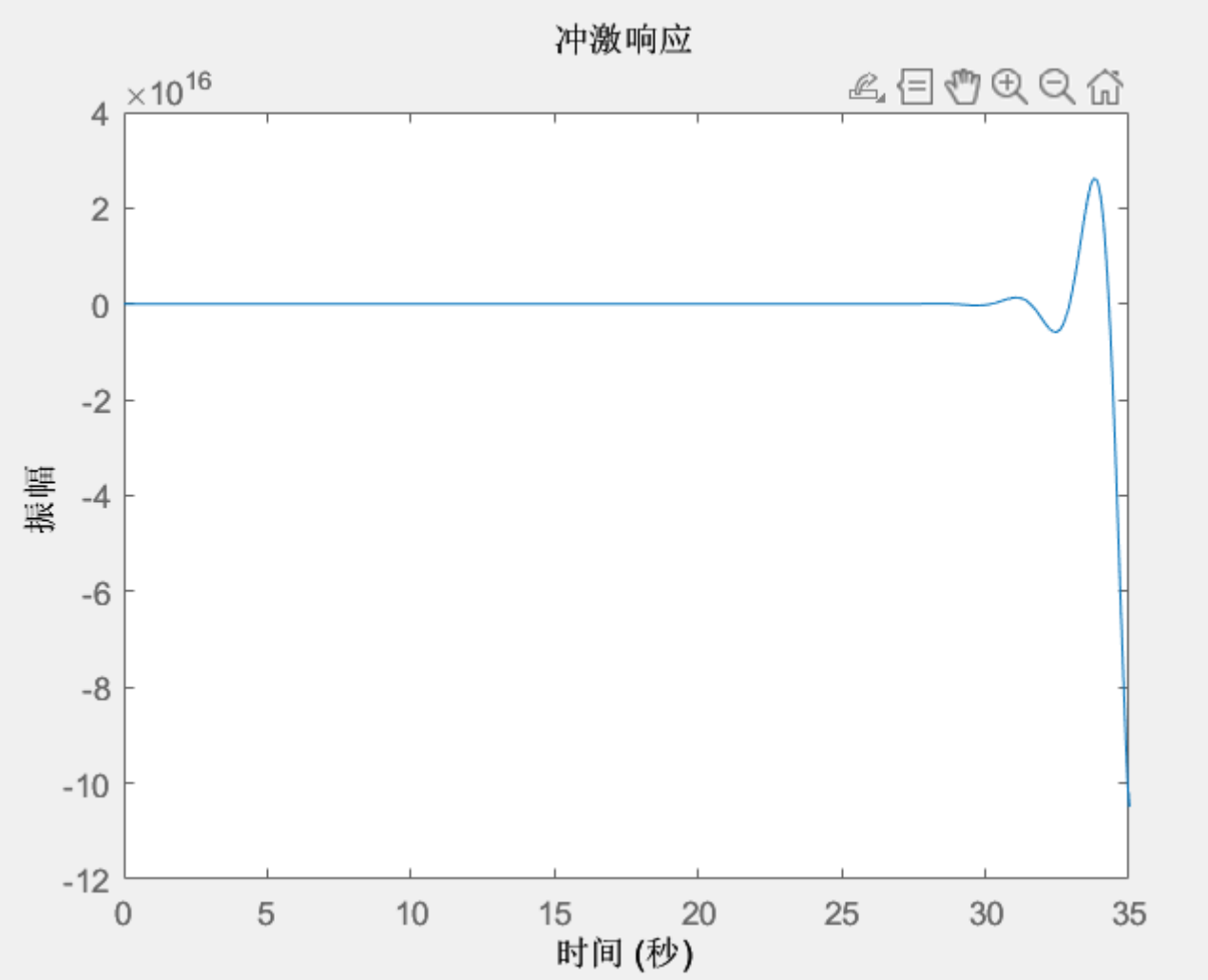
```
num = [50];
den = [1, 4, -7,-10];
H = tf(num, den);

nyquist(H);
```



由图易得，系统不稳定

闭环系统脉冲响应

```
G = H/(1+H);
impulse(G);
```



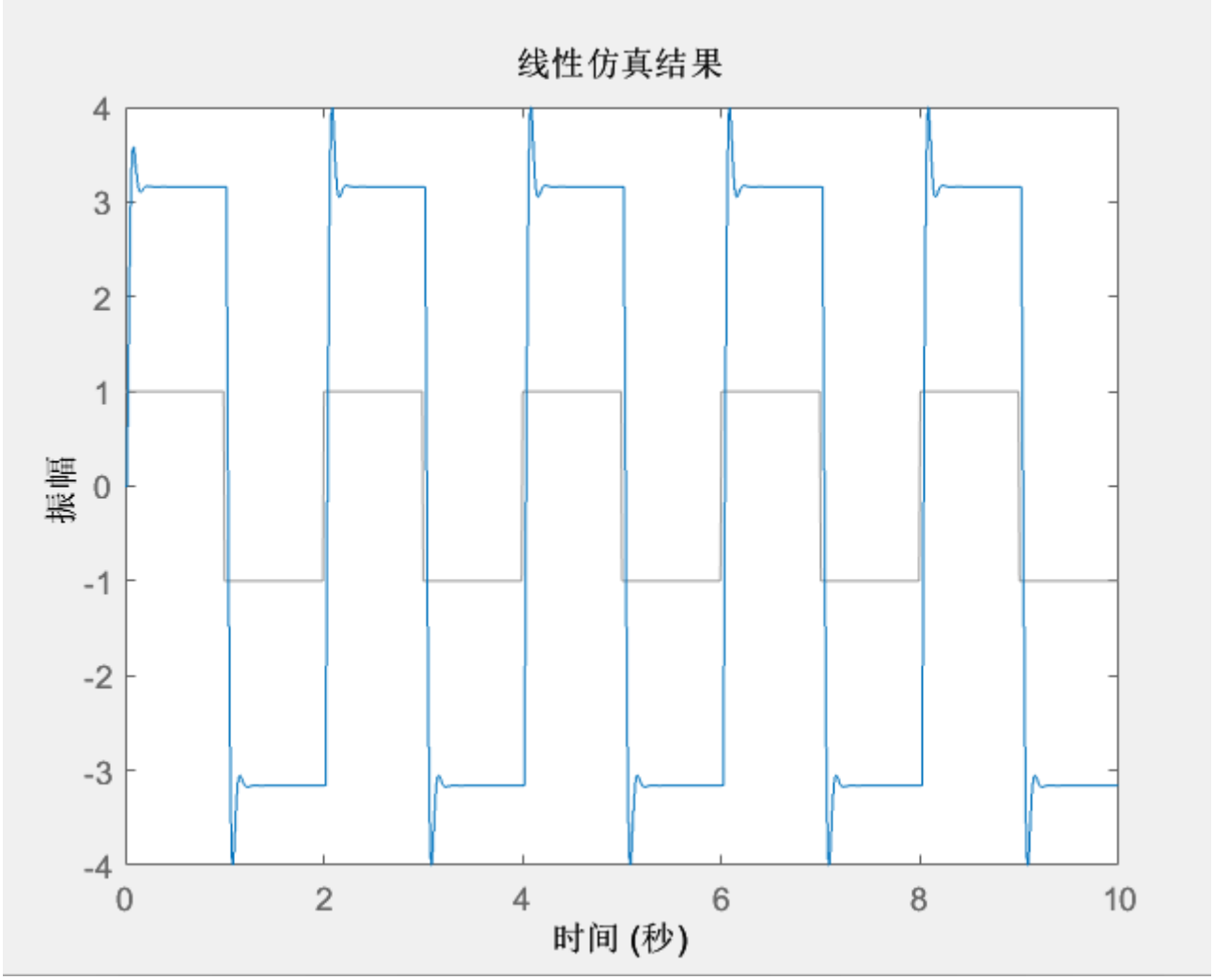
exp2

```
num = [1, 1];
den = [1, 6, 13, 10];
sys = tf(num, den);

Km = 0;  % 初始化增益裕度（Km）值

for K = 40:0.001:100 % 多次试探后初始值设为40
    [~, PM, ~, ~] = margin(K * sys);
    if PM <= 45
        Km = K - 0.001;  % 减去步长
        break;
    end
end

disp(['相位裕度大于 45°时的增益裕度（Km）值：', num2str(Km)]);
```

```
>> exp4_2
相位裕度大于 45°时的增益裕度（Km）值：43.687
```

实验内容5

```
num=0.632;
den=[1,-1.368,0.568];
sys=tf(num,den,0.01); %将采样周期取为0.01

u=[];
for i=1:10
    if mod(i,2)==1
        u=[u,ones(1,100)];
    end
    if mod(i,2)==0
        u=[u,-ones(1,100)];
    end
end
% 以上手动处理了一下输入信号

t=0:0.01:9.99;
lsim(sys,u,t);
```



实验内容6

exp1

使用place函数

```
A = [-2 -3; 4 -9];
B = [3;1];

p = [-1+2j,-1-2j];
K = place(A,B,p)
```

```
K =

   -5.6111    7.8333
```

直接法

```
A = [-2 -3; 4 -9];
B = [3;1];
```

```
syms s
delta_s = det(s*eye(2)-A);
coefficients = coeffs(delta_s, s);
delta_s1 = (s+1+2j)*(s+1-2j);
coefficients1 = coeffs(delta_s1,s);

Kc = coefficients1 - coefficients;
Kc(end) = [] ;

Qc = [B A*B];
L = [coefficients(2) 1;1 0];
Tc = Qc*L;
Tc1 = Tc^(-1);

Kp = Kc*Tc1
```

```
Kp =

[-101/18, 47/6]
```

两种方法结果一致

exp2

直接法

```
A = [1 0 0;0 2 1;0 0 2];
C = [1 1 0];

syms s
delta_s = det(s*eye(3)-A);
coefficients = coeffs(delta_s, s);
delta_s1 = (s+3)*(s+4)*(s+5);
coefficients1 = coeffs(delta_s1,s);

Ho = coefficients1 - coefficients;
Ho(end) = [] ;

Qo = [C; C*A; C*A*A];
a1 = coefficients(2);
a2 = coefficients(3);
L = [a1 a2 1; a2 1 0; 1 0 0];
To1 = L*Qo;
To = To1^(-1);

H = To*transpose(Ho)
A = A-H*C
```

```
H =

 120
-103
 210


A =

[-119, -120, 0]
[ 103,  105, 1]
[-210, -210, 2]
```

采用estim,可以看到得到的结果其实是一样的

```
% 定义系统的状态空间模型
A = [1 0 0;0 2 1;0 0 2];
C = [1 1 0];
sys = ss(A,[],C,[]);

% 设计全维状态观测器，使其极点为-3, -4, -5
p = [-3 -4 -5];
L = place(A',C',p)'

% 使用estim得到全维状态观测器
ob = estim(sys,L)
```

```
L =

  120.0000
 -103.0000
  210.0000


ob =

  A =
         x1_e  x2_e  x3_e
   x1_e  -119  -120     0
   x2_e   103   105     1
   x3_e  -210  -210     2
```