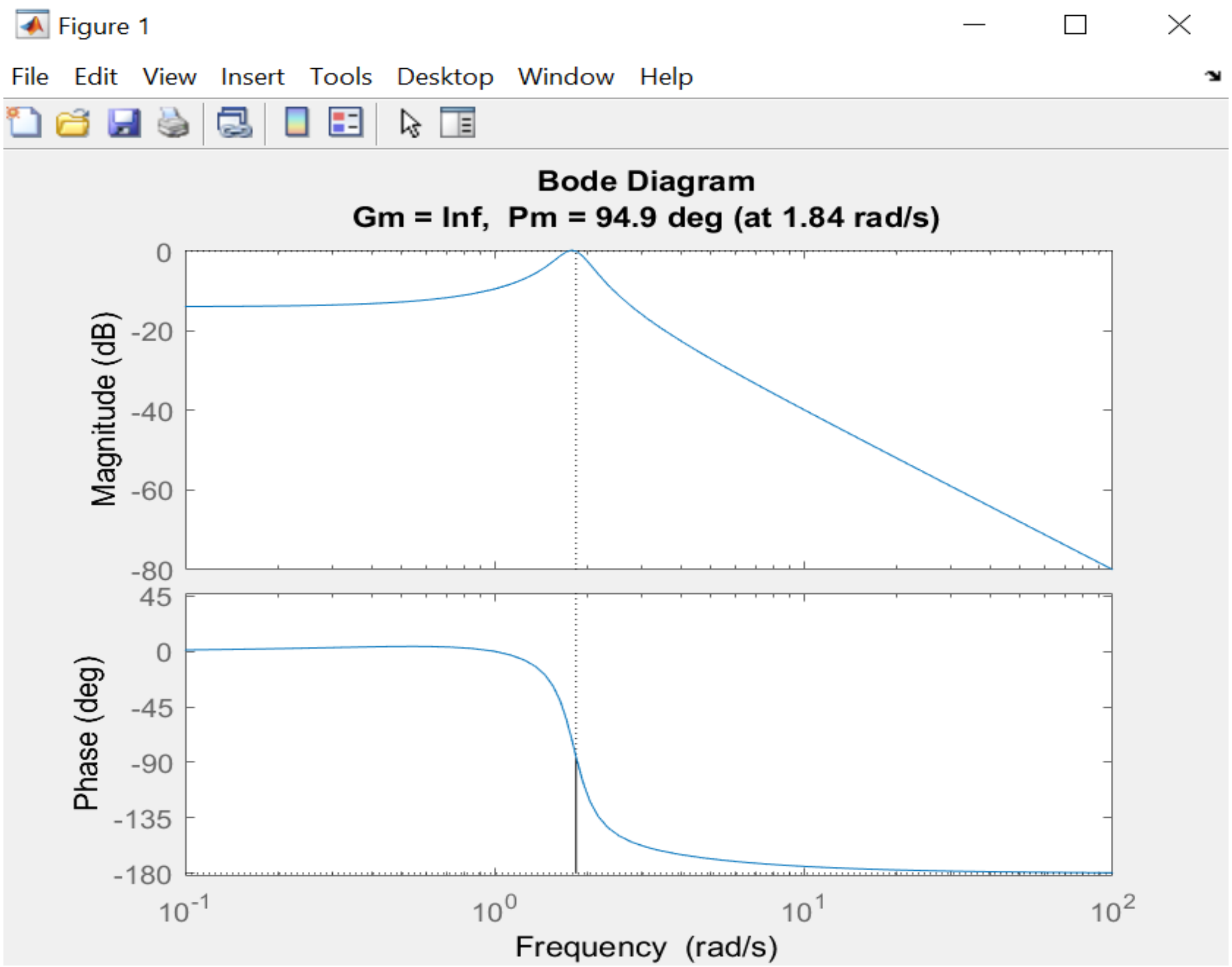
1a) Gain margin = Infinity, Phase margin = 94.9 degrees and system is stable.

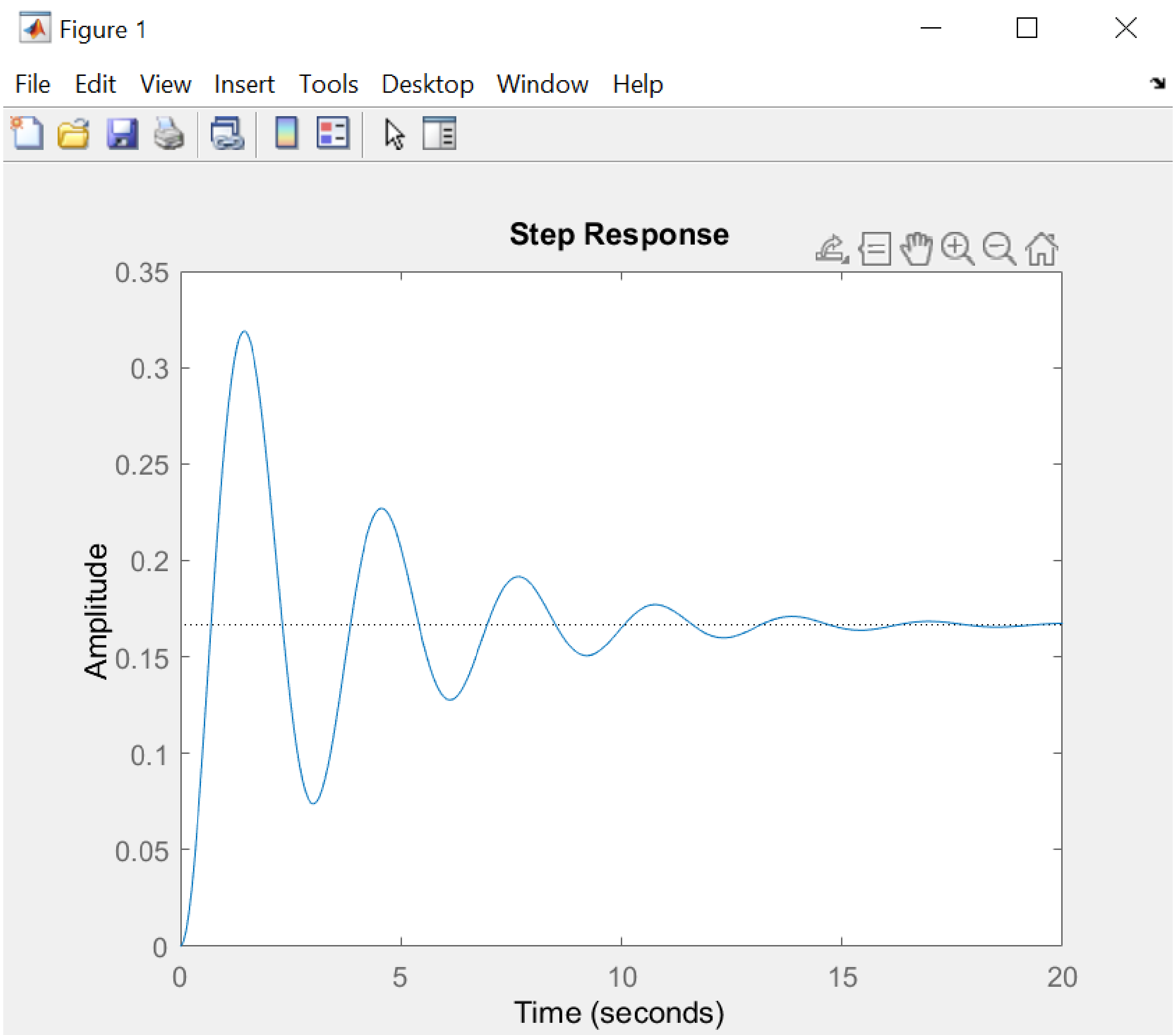


1b) C1 = G1/ (1+G1)

C1 = (s+1)/ ((s+1) + (s^3 + 2s^2+4s+5))

C1 = (s+1)/ (s^3 + 2s^2 + 5s + 6)

1c)



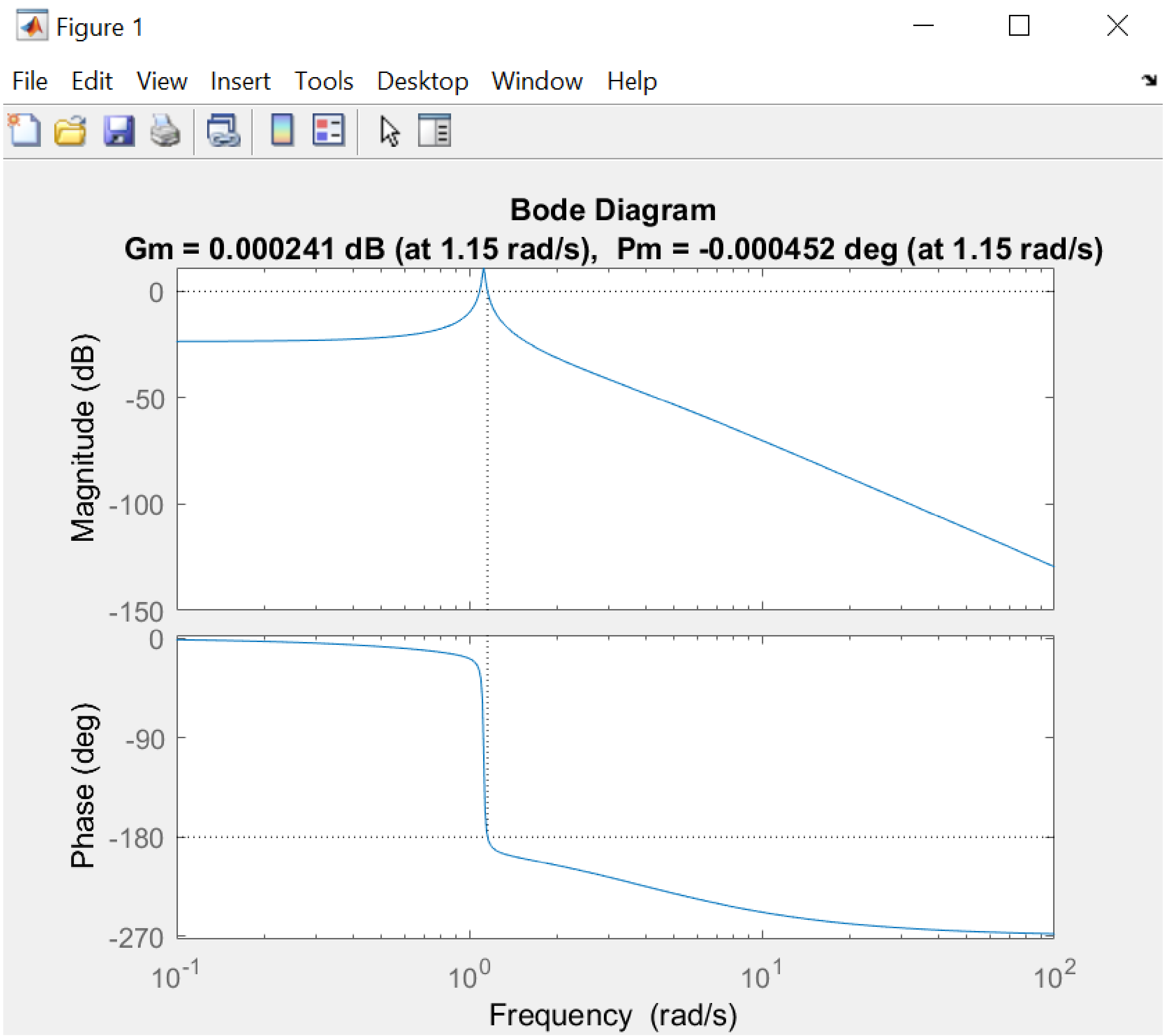
d) ans =

-0.2836 + 2.0266i

-0.2836 - 2.0266i

-1.4329 + 0.0000i

2a) Gain margin = 0.000241 dB, Phase margin = -0.000452 degrees and system is unstable.

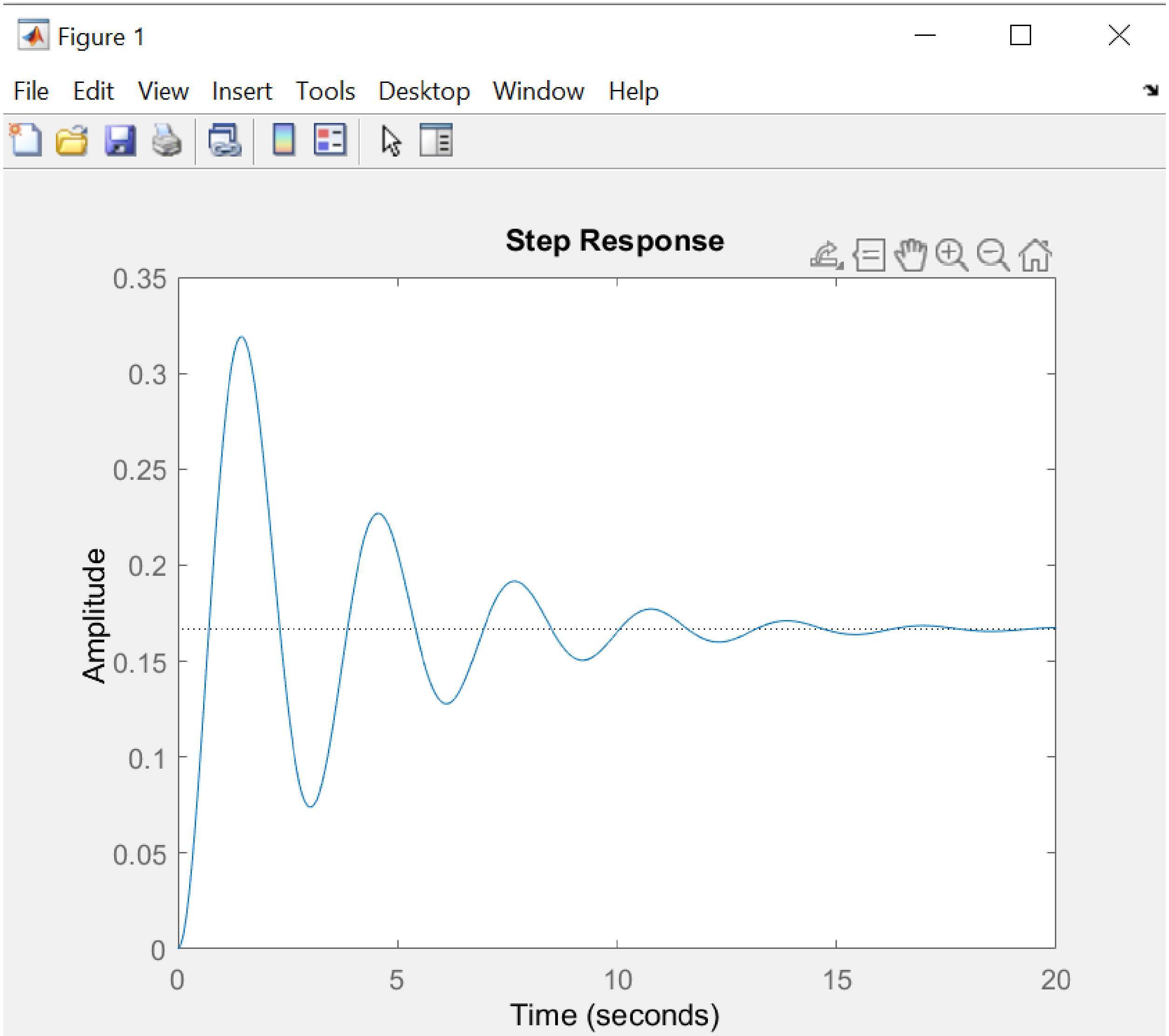


2b)

C2 = G2/ (1 + G2)

C2 = 1/ (3s^3 + 12s^2 + 4s + 16)

2c)



2d)

ans =

-4.0000 + 0.0000i

-0.0000 + 1.1547i

-0.0000 - 1.1547i

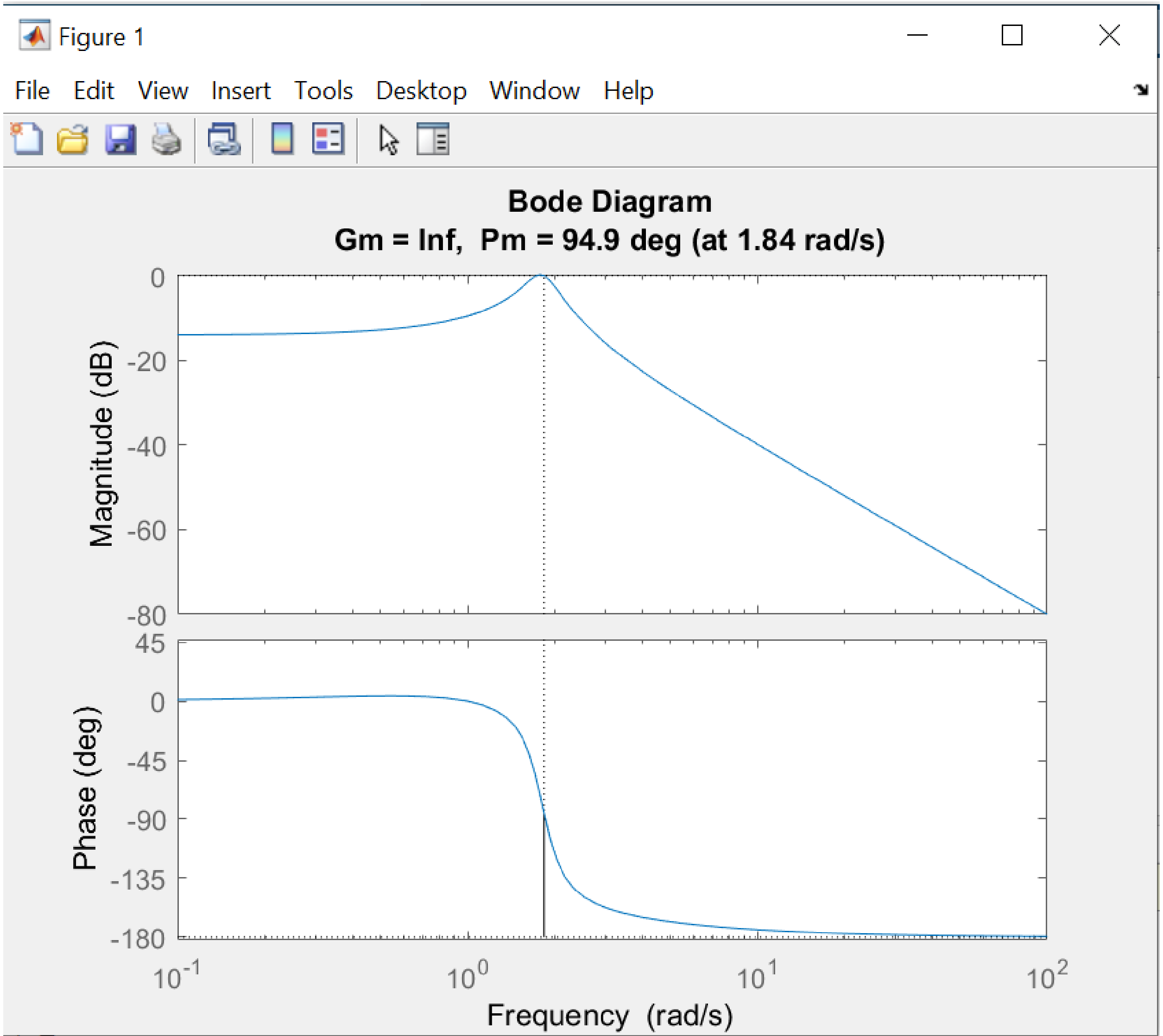
Matlab code for Experiment 1

```
G1 = tf([1 1], [1 2 4 5]);
margin(G1);
C1= tf([1 1],[1 2 5 6]);
step(C1);
roots([1 2 5 6])

G2 = tf([1], [3 12 4 15]);
margin(G2);
C2= tf([1 1],[3 12 4 16]);
step(C2);
roots([3 12 4 16])
```

Experiment 2

1a) Gain margin = Infinity, Phase margin=94.9 degrees and system is stable.



1b)

When K= 0.5

C1 =

```
        0.5
  ---------------------
  s^3 + 4 s^2 + 2 s + 5
```

When K= 1.5

C2 =

```
        1.5
  ---------------------
  s^3 + 4 s^2 + 2 s + 5
```

1c)

Roots of system when K =0.5

ans =

```
  -3.8191 + 0.0000i
  -0.0904 + 1.1406i
  -0.0904 - 1.1406i
```

Roots of system when K=1.5

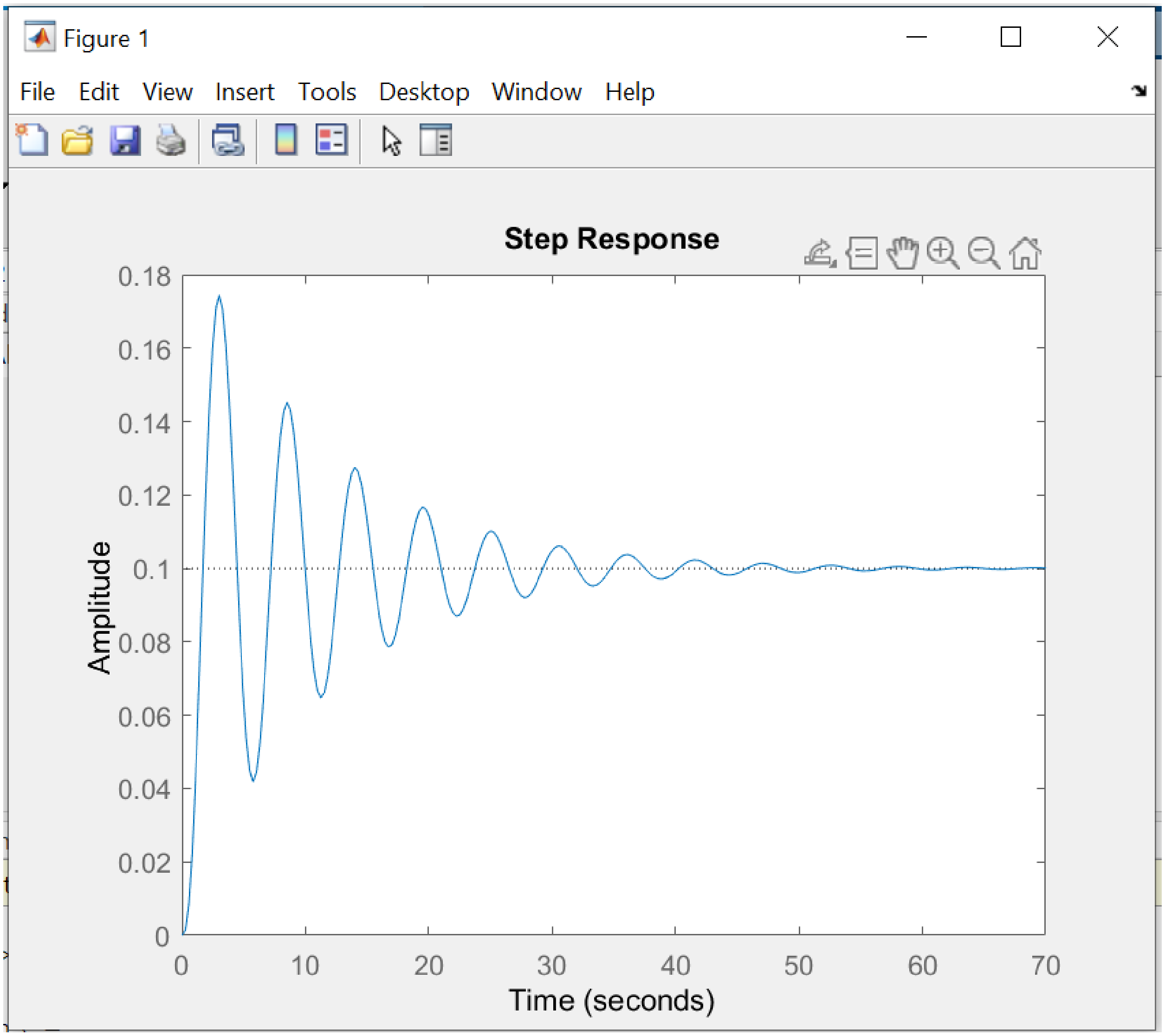
ans =

-3.8191 + 0.0000i

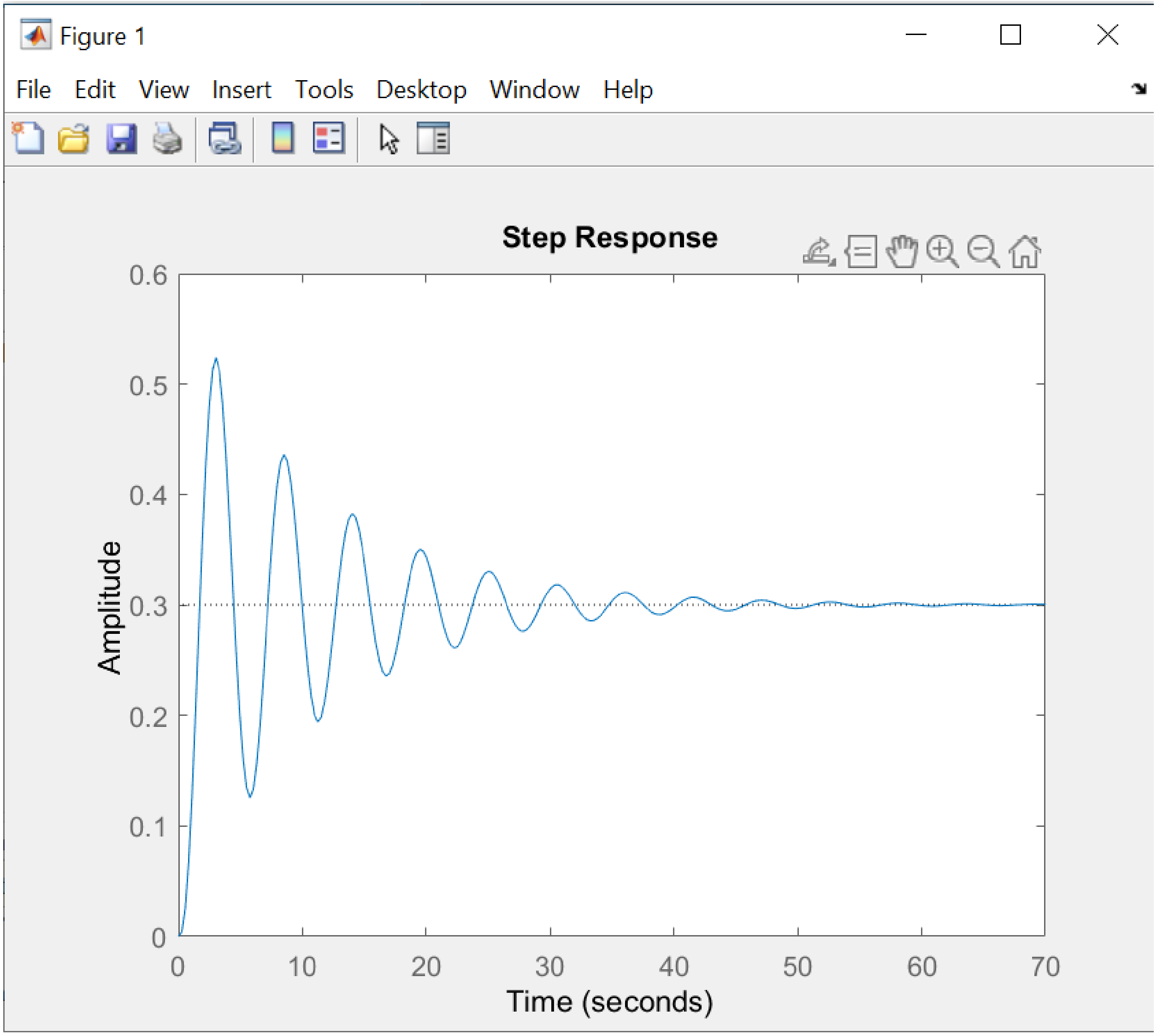
-0.0904 + 1.1406i

-0.0904 - 1.1406i

1d) When K=0.5 and its magnitude decreases with respect to time.



When K = 1.5 and its magnitude decreases with respect to time.



Matlab Code for Experiment 2

```
G1 = tf([1], [1 4 2 5]);
margin(G1);
C1= series([0.5],[G1]);
C2= series([1.5],[G1]);
step(C1);
step(C2);
roots([1 4 2 5])
```