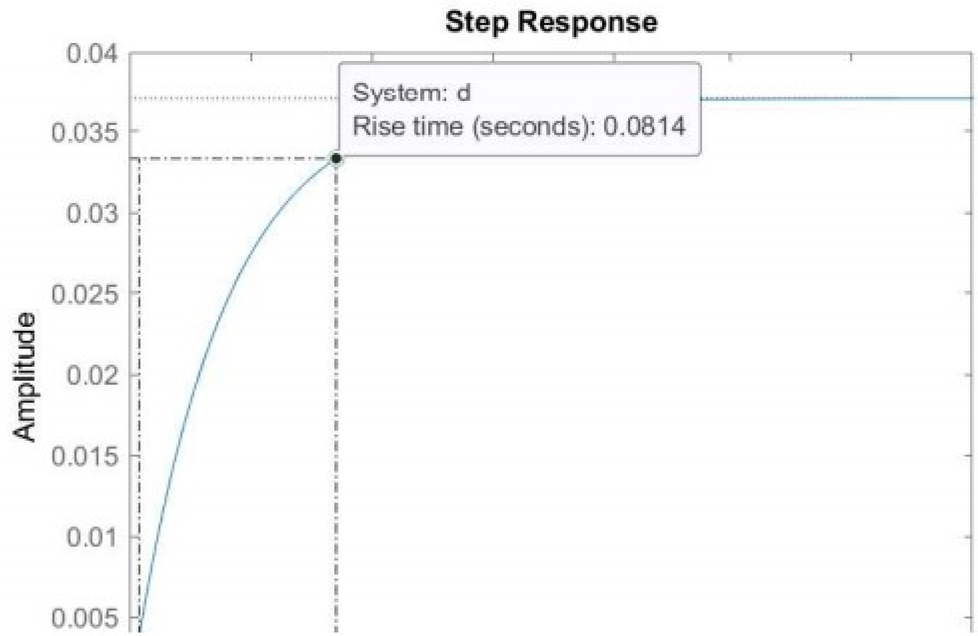
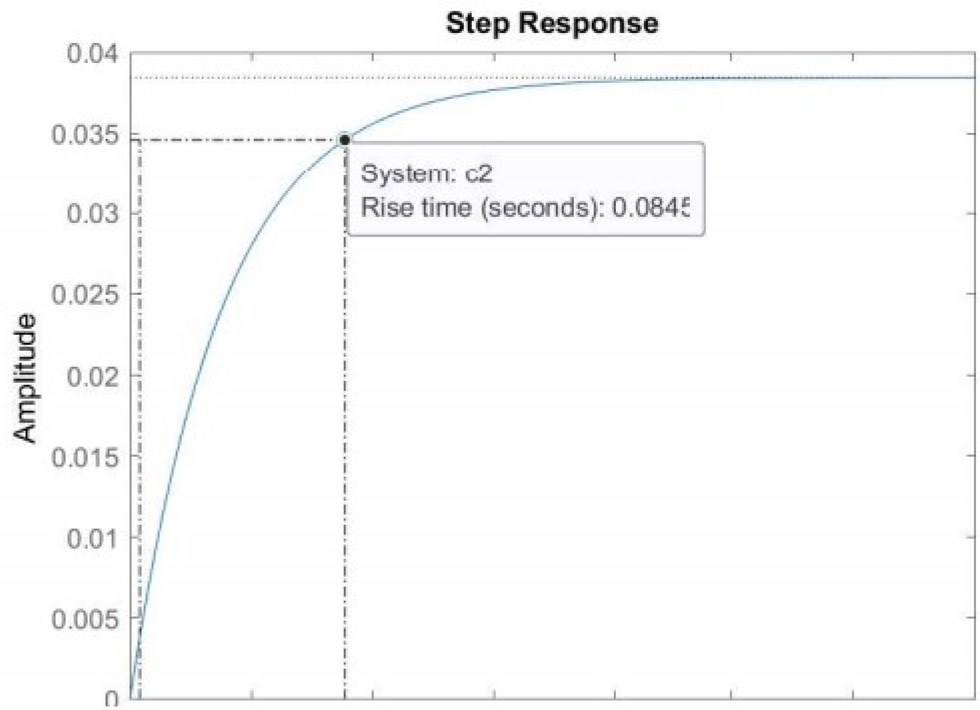
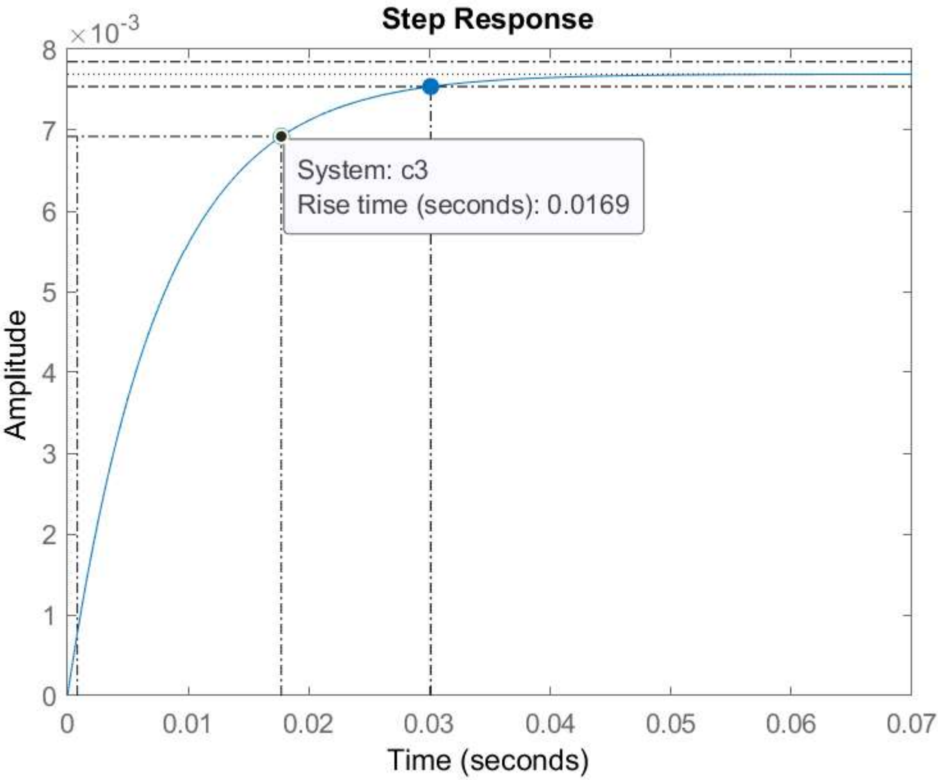
```
>> %%step response of a unit feedback system
>> %%G(s)=1/(s+26)
>> a=[0 1];
>> b=[1 26];
>> c=tf(a,b)

c =

    1
  ------
  s + 26

Continuous-time transfer function.

>> d=feedback(c,1)

d =

    1
  ------
  s + 27

Continuous-time transfer function.

>> step(d);
>>
```


Step Response
System: d
Rise time (seconds): 0.0814
Amplitude
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005

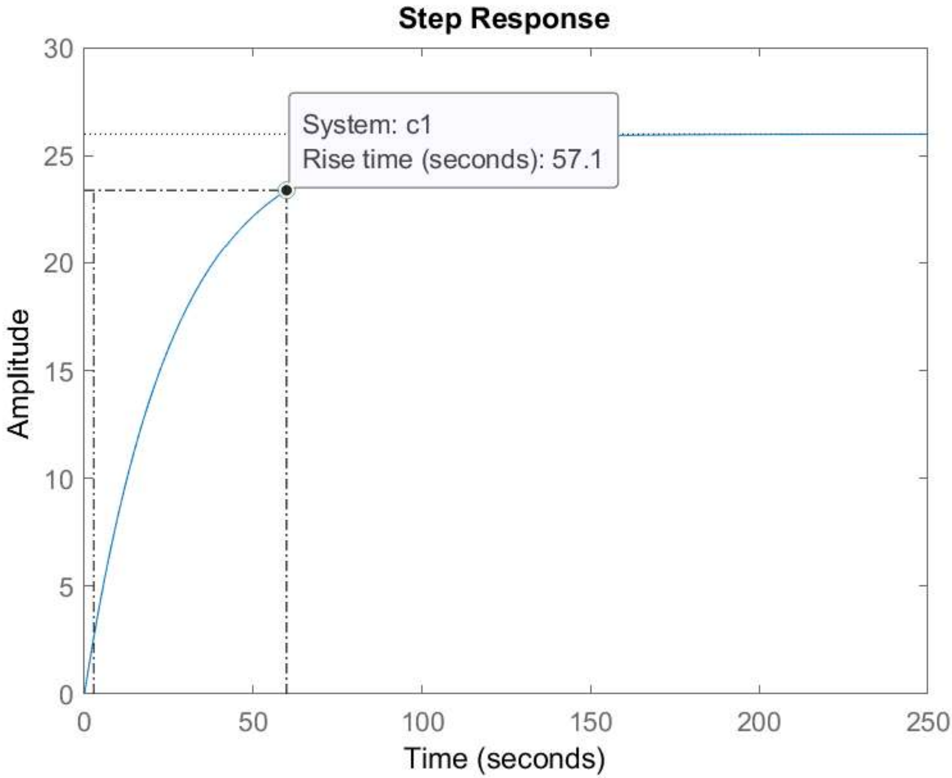
```
>> %step response of first order unity feedback system
>> %%pole at -R
>> a2=1;
>> r=26;
>> b2=[1 r];
>> c2=tf(a2,b2)

c2 =

     1
  ------
  s + 26

Continuous-time transfer function.

>> step(c2);
>>
```


Step Response
Amplitude
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
System: c2
Rise time (seconds): 0.0845

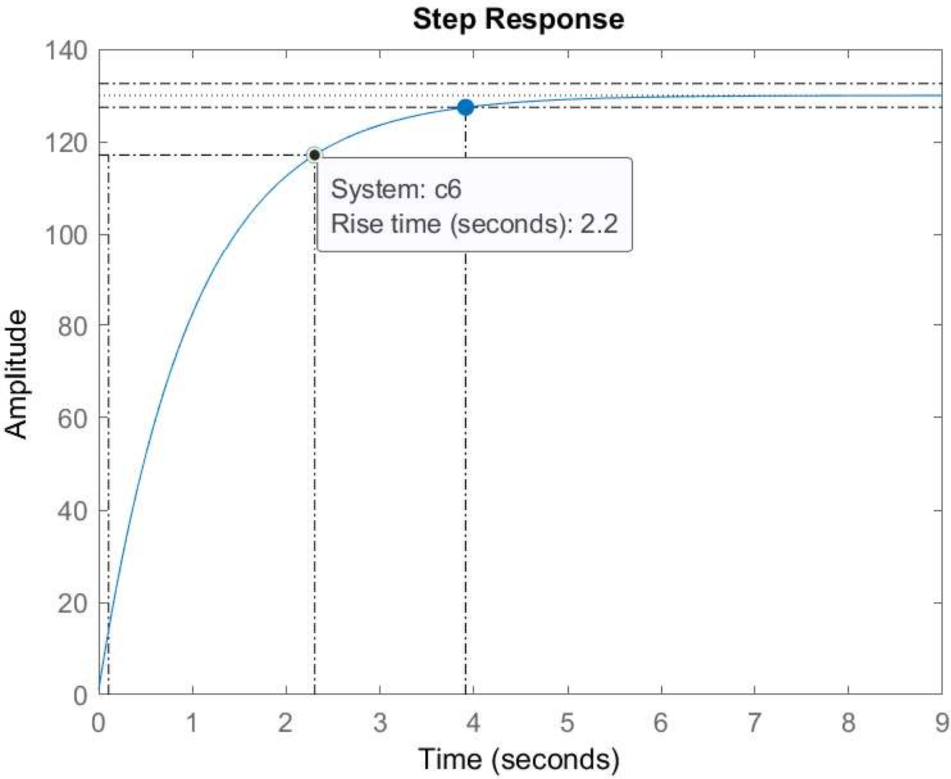
```
>> %%step response of dfirst order unity feedbacksystem
>> %%pole at -5R
>> a3=1;
>> r=26;
>> b3=[1 5*r];
>> c3=tf(a3,b3)

c3 =

     1
  -------
  s + 130

Continuous-time transfer function.

>> step(c3);
>>
```


Step Response
×10-3
8
7
6
5
4
3
2
1
0
Amplitude
System: c3
Rise time (seconds): 0.0169
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
Time (seconds)

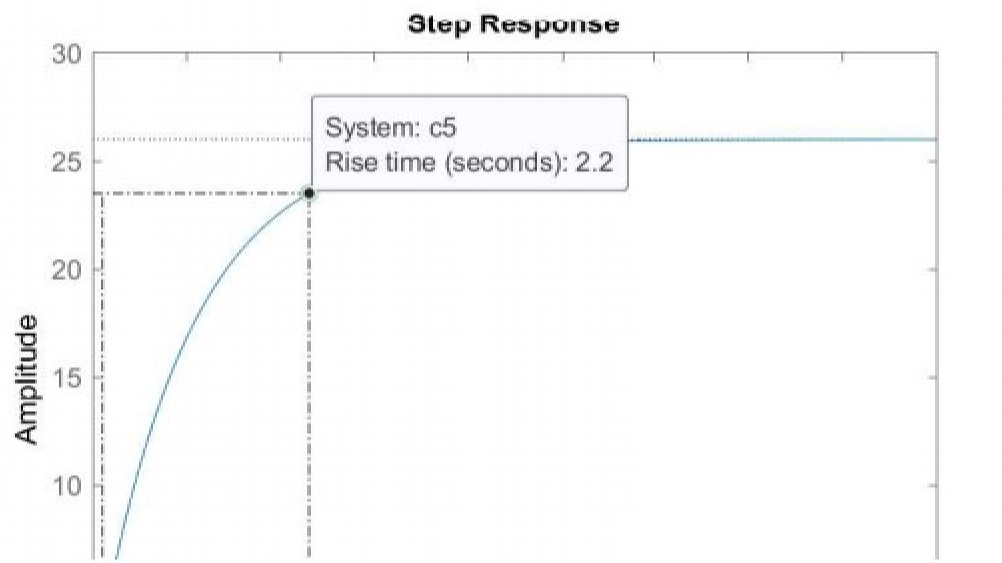
```
>> %%step response of first order unity feedback system
>> %%placing pole at - 1/R
>> a1=1

a1 =

     1

>> R=26;
>> b1=[1,1/R];
>> c1=tf(a1,b1)

c1 =

       1
  -----------
  s + 0.03846

Continuous-time transfer function.

>> step(c1);
>>
```


Step Response
System: c1
Rise time (seconds): 57.1
Amplitude
Time (seconds)
0
5
10
15
20
25
30
0
50
100
150
200
250

```
>> %%step response for first order unity feedback system
>> %%placing zero at -5R
>> r=26;
>> a6=[1 5*r];
>> b6=[1 1];
>> c6=tf(a6,b6)

c6 =

  s + 130
  -------
   s + 1

Continuous-time transfer function.

>> step(c6);
>>
```

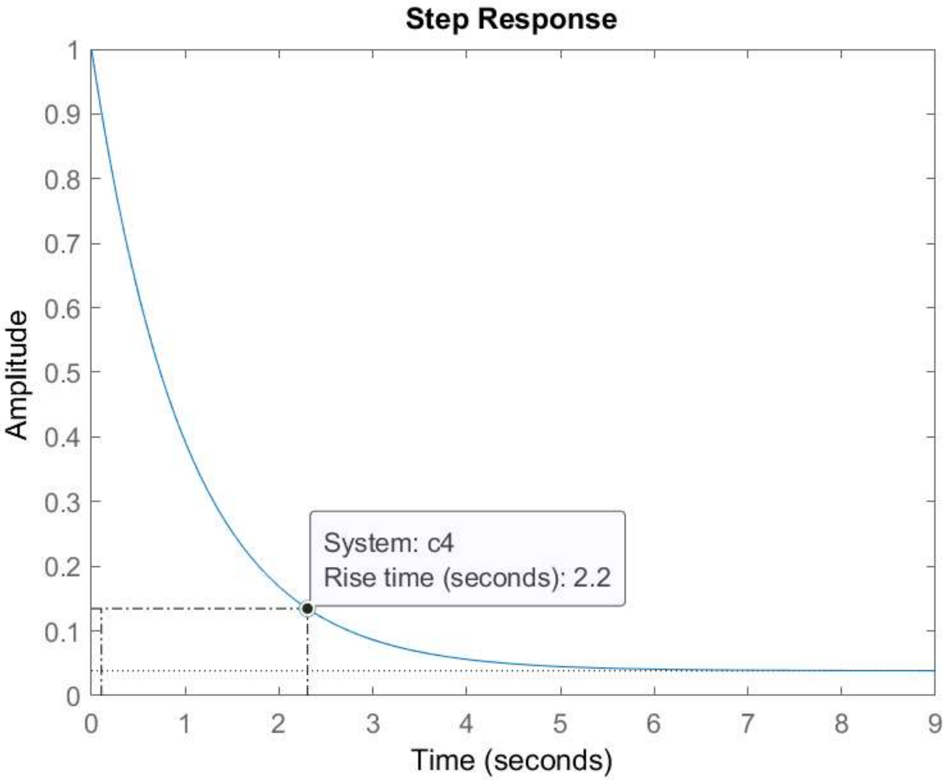

Step Response
Amplitude
Time (seconds)
System: c6
Rise time (seconds): 2.2
0
20
40
60
80
100
120
140
0
1
2
3
4
5
6
7
8
9

```
>> %%step response of first order unity feedback system
>> %%placing zero to a transfer function at -R
>> r=26;
>> a5=[1 r]

a5 =

     1    26

>> b5=[1 1];
>> c5=tf(a5,b5)

c5 =

  s + 26
  ------
  s + 1

Continuous-time transfer function.

>> step(c5);
>>
```

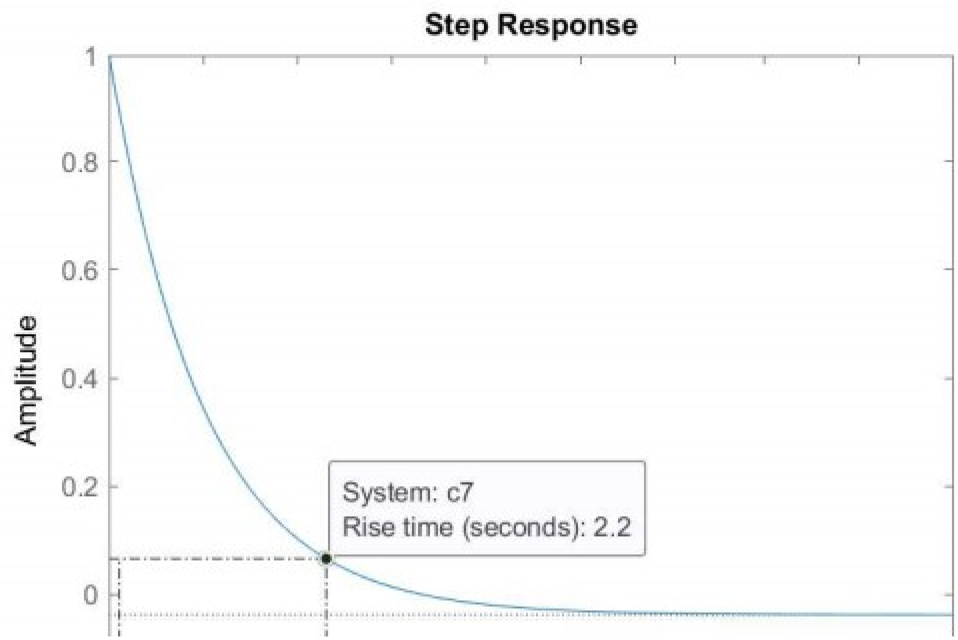


Step Response
30
25
20
15
10
Amplitude
System: c5
Rise time (seconds): 2.2

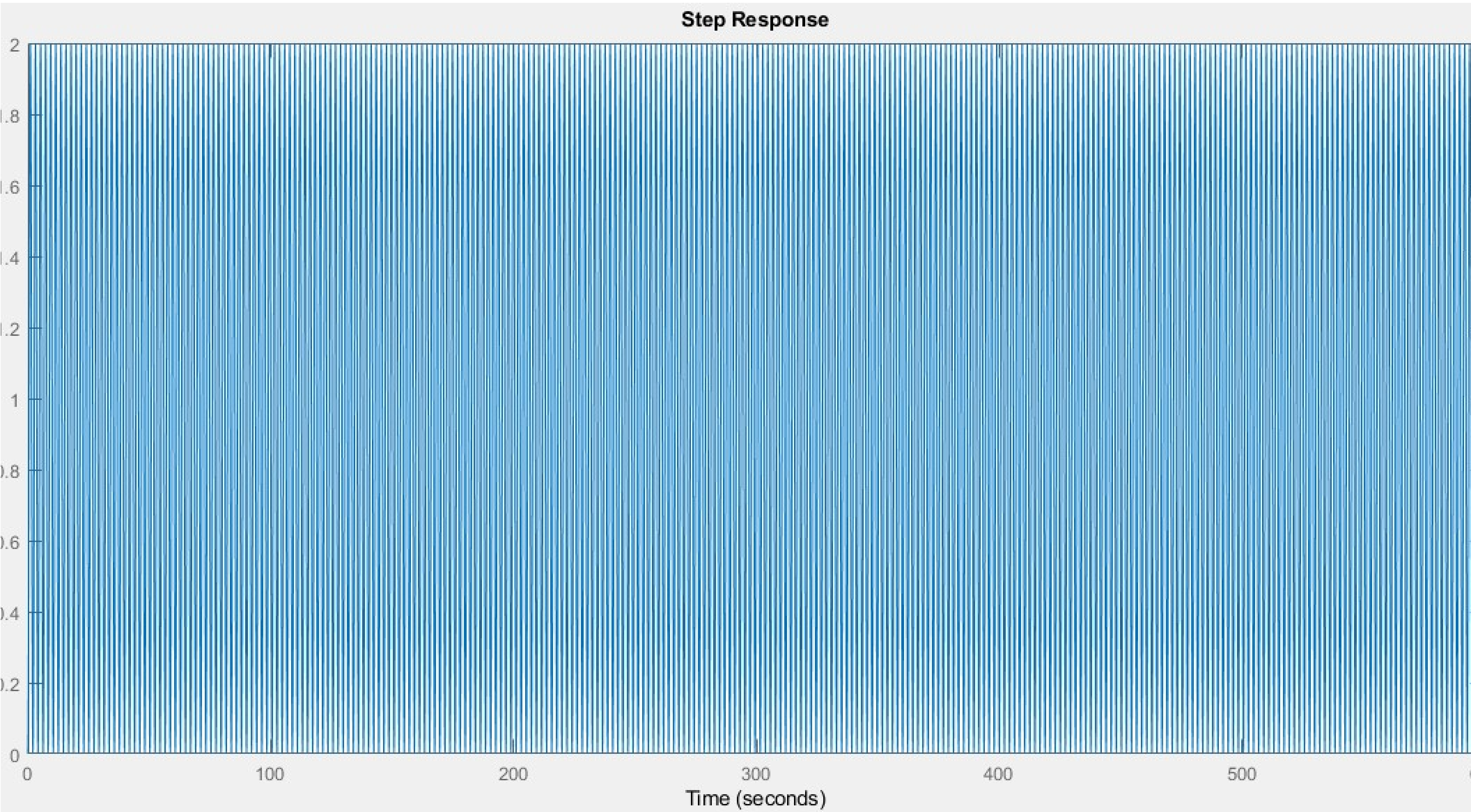
```
>> %%step response of first order unity feedback system
>> %%placing zeros for transfer function 1/(1+s)
>> %% at - inverse R
>> r=26;
>> a4=[1 1/r];
>> b4=[1 1];
>> c4=tf(a4,b4)

c4 =

  s + 0.03846
  -----------
     s + 1

Continuous-time transfer function.

>> step(c4);
>>
```


Step Response
System: c4
Rise time (seconds): 2.2
Amplitude
Time (seconds)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
4
5
6
7
8
9

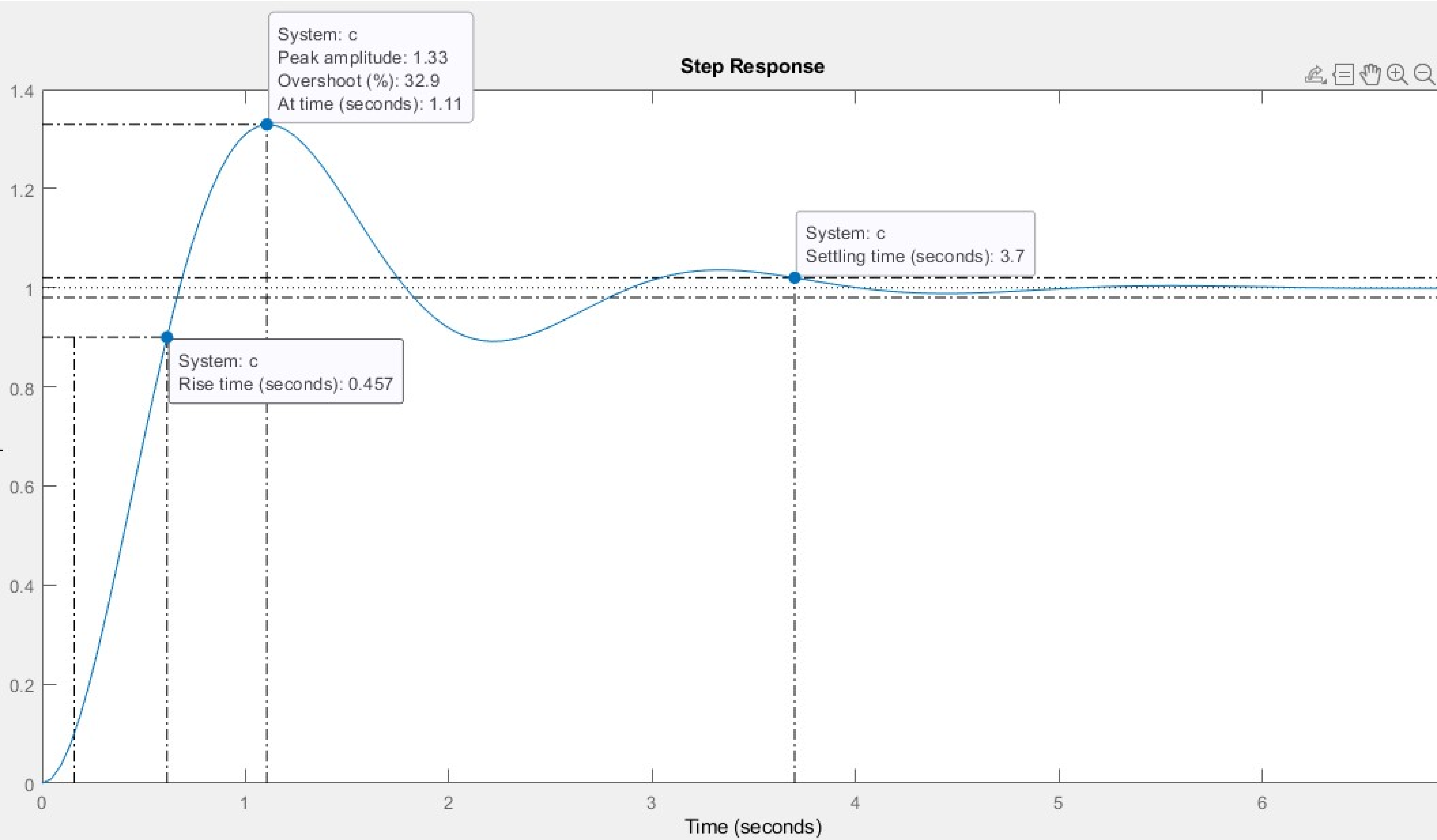
```
>> %%step response of a first order unity feedback system
>> %%placing zero at inverse of R
>> r=26;
>> a7=[1 -1/26];
>> b7=[1 1];
>> c7=tf(a7,b7)

c7 =

  s - 0.03846
  -----------
     s + 1

Continuous-time transfer function.

>> step(c7);
>>
```


Step Response
Amplitude
1
0.8
0.6
0.4
0.2
0
System: c7
Rise time (seconds): 2.2

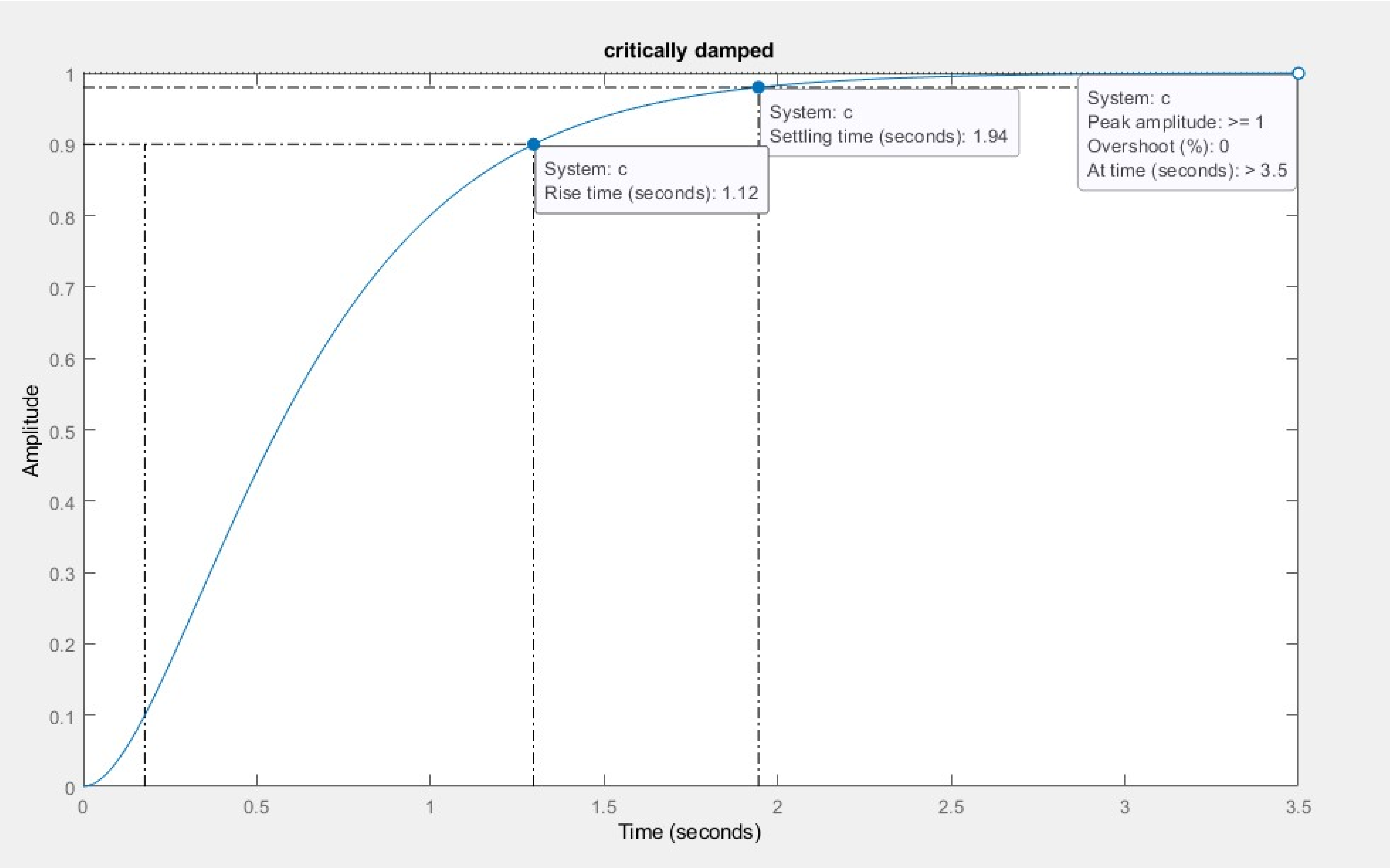
```
>> %% second order undamped system
>> e=0;
>> wn=3;
>> a=[wn*wn];
>> b=[1 2*e*wn wn*wn];
>> c=tf(a,b)

c =

      9
  -------
  s^2 + 9

Continuous-time transfer function.

>> step(c);
```


Step Response
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
100
200
300
400
500
Time (seconds)

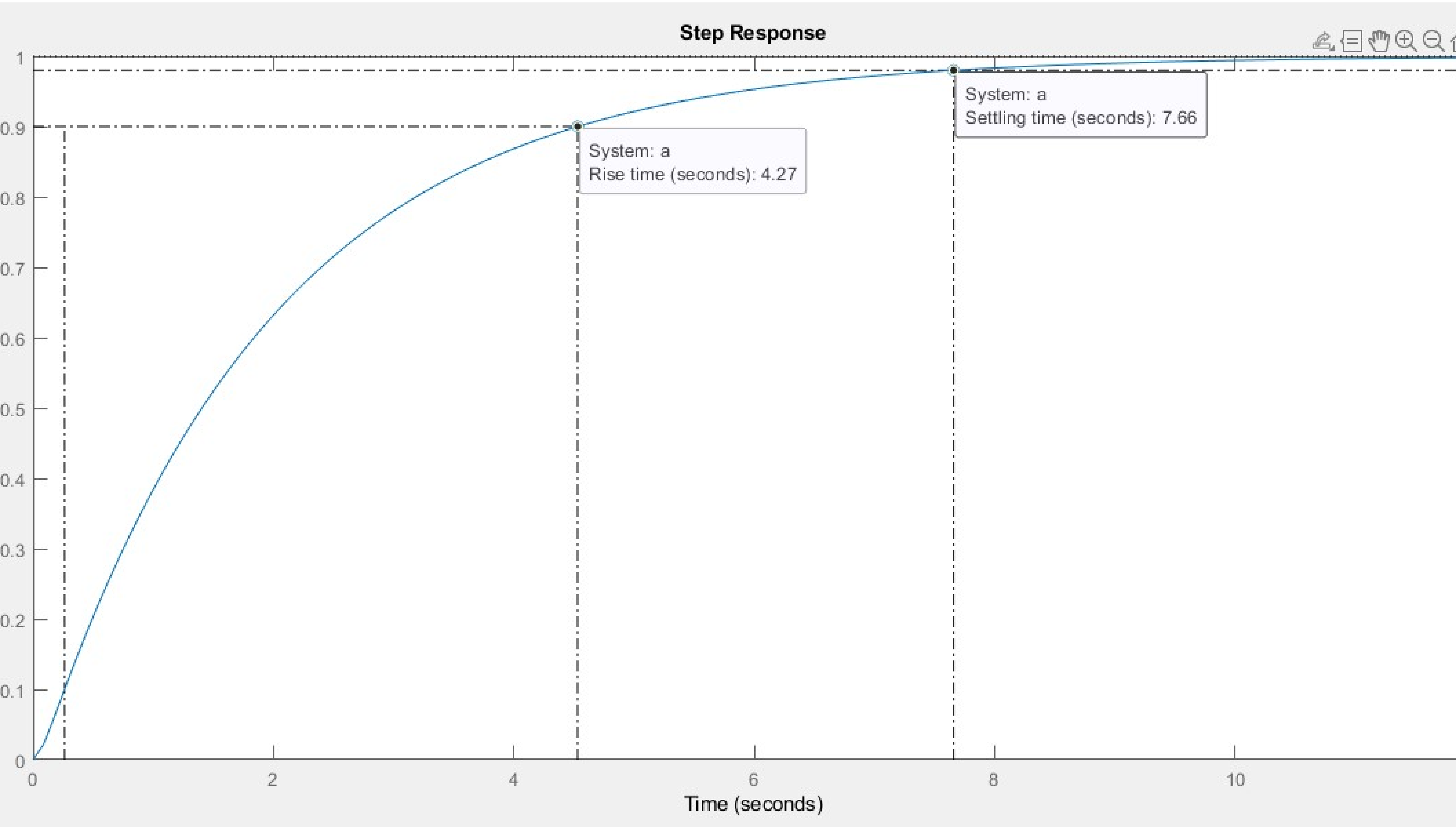
```
>> %%second order underdamped system
>> wn=3;
>> e=1/3;
>> a1=[wn*wn];
>> b1=[1 2*e*wn wn*wn];
>> c1=tf(a1,b1)

c1 =

        9
  -------------
  s^2 + 2 s + 9

Continuous-time transfer function.

>> step(c1);
>> stepinfo(c1)

ans =

  struct with fields:

        RiseTime: 0.4568
    SettlingTime: 3.7005
     SettlingMin: 0.8916
     SettlingMax: 1.3293
       Overshoot: 32.9277
      Undershoot: 0
            Peak: 1.3293
        PeakTime: 1.1052

>>
```


Step Response
System: c
Peak amplitude: 1.33
Overshoot (%): 32.9
At time (seconds): 1.11
System: c
Settling time (seconds): 3.7
System: c
Rise time (seconds): 0.457
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
1
2
3
4
5
6
Time (seconds)

```
>> %%second order critically damped system
>> wn=3;
>> e=1;
>> a=[wn*wn];
>> b=[1 2*e*wn wn*wn];
>> c=tf(a,b);
>> step(c);
>> stepinfo(c)

ans =

  struct with fields:

        RiseTime: 1.1194
    SettlingTime: 1.9447
     SettlingMin: 0.9019
     SettlingMax: 0.9999
       Overshoot: 0
      Undershoot: 0
            Peak: 0.9999
        PeakTime: 3.9758
```

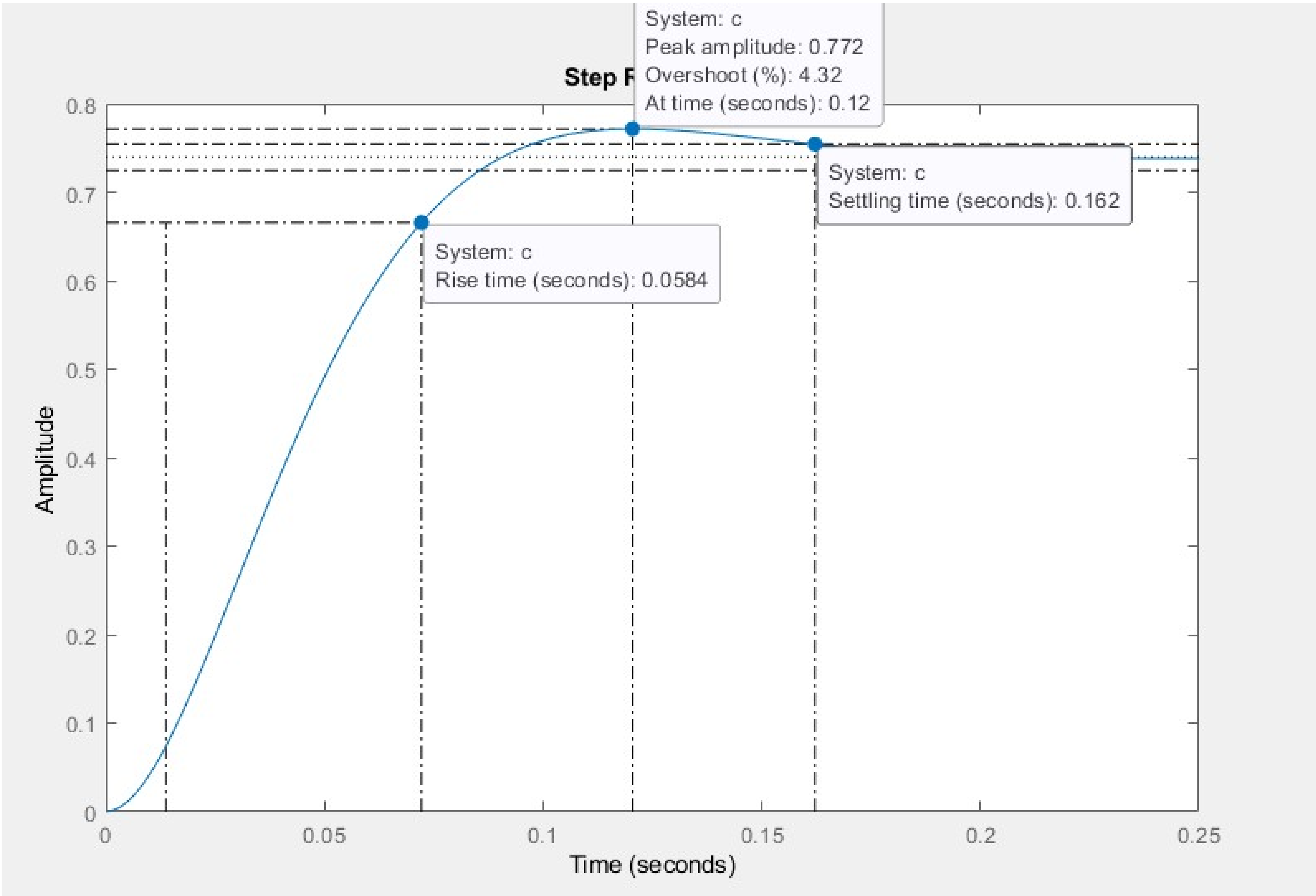

critically damped
System: c
Settling time (seconds): 1.94
System: c
Peak amplitude: >= 1
Overshoot (%): 0
At time (seconds): > 3.5
System: c
Rise time (seconds): 1.12
Amplitude
Time (seconds)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0.5
1.5
2
2.5
3
3.5

```
>> %%second order overdamped system
>> wn=3;
>> e=3;
>> a=[wn*wn];
>> b=[1 2*e*wn wn*wn];
>> c=tf(a,b);
>> step(c);
>> stepinfo(c)

ans =

  struct with fields:

        RiseTime: 4.2699
    SettlingTime: 7.6589
     SettlingMin: 0.9016
     SettlingMax: 0.9993
       Overshoot: 0
      Undershoot: 0
            Peak: 0.9993
        PeakTime: 14.2257

>>
```

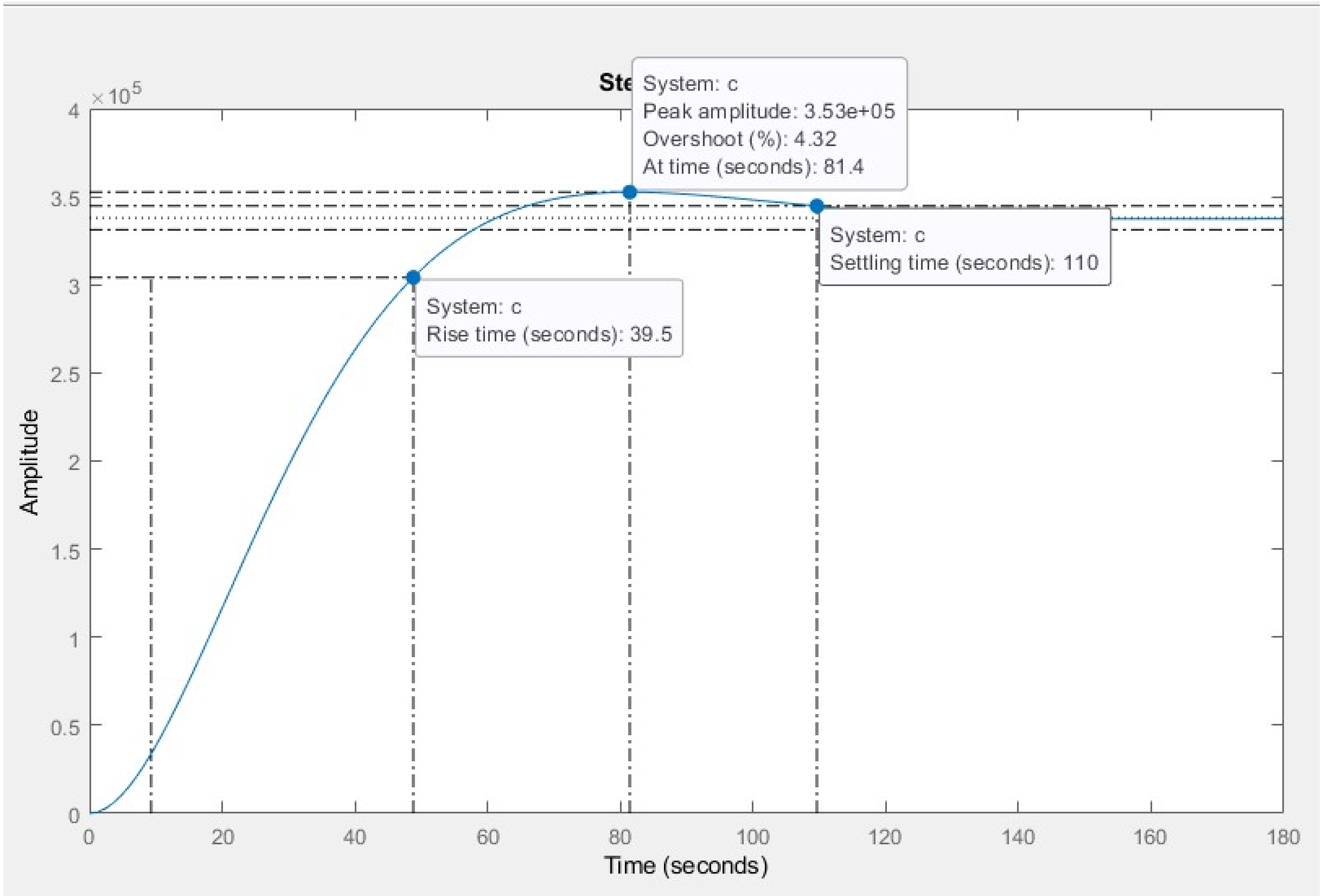


Step Response
System: a
Rise time (seconds): 4.27
System: a
Settling time (seconds): 7.66
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
Time (seconds)

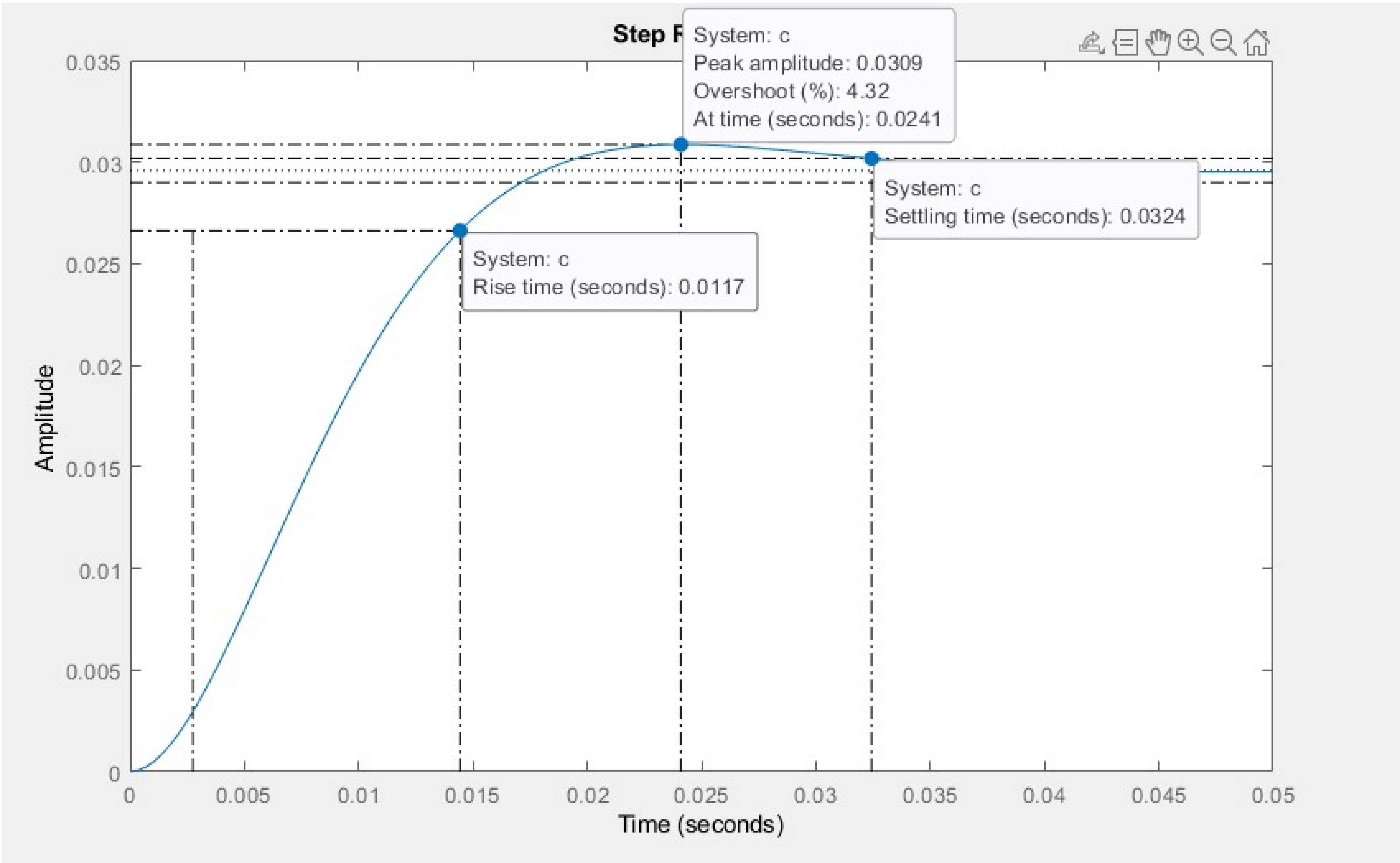
```
>> %if a system has pole pairs (-a+ai,-a-ai) at a=(r)
>> r=26;
>> z=[];
>> p=[-26+26i,-26-26i];
>> k=1000;
>> c=zpk(z,p,k)

c =

         1000
  ------------------
  (s^2 + 52s + 1352)

Continuous-time zero/pole/gain model.

>> step(c);
>> stepinfo(c)

ans =

  struct with fields:

        RiseTime: 0.0584
    SettlingTime: 0.1622
     SettlingMin: 0.6682
     SettlingMax: 0.7716
       Overshoot: 4.3210
      Undershoot: 0
            Peak: 0.7716
        PeakTime: 0.1204

>>
```


System: c
Peak amplitude: 0.772
Overshoot (%): 4.32
At time (seconds): 0.12
Step R
System: c
Settling time (seconds): 0.162
System: c
Rise time (seconds): 0.0584
Amplitude
Time (seconds)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.05
0.1
0.15
0.2
0.25

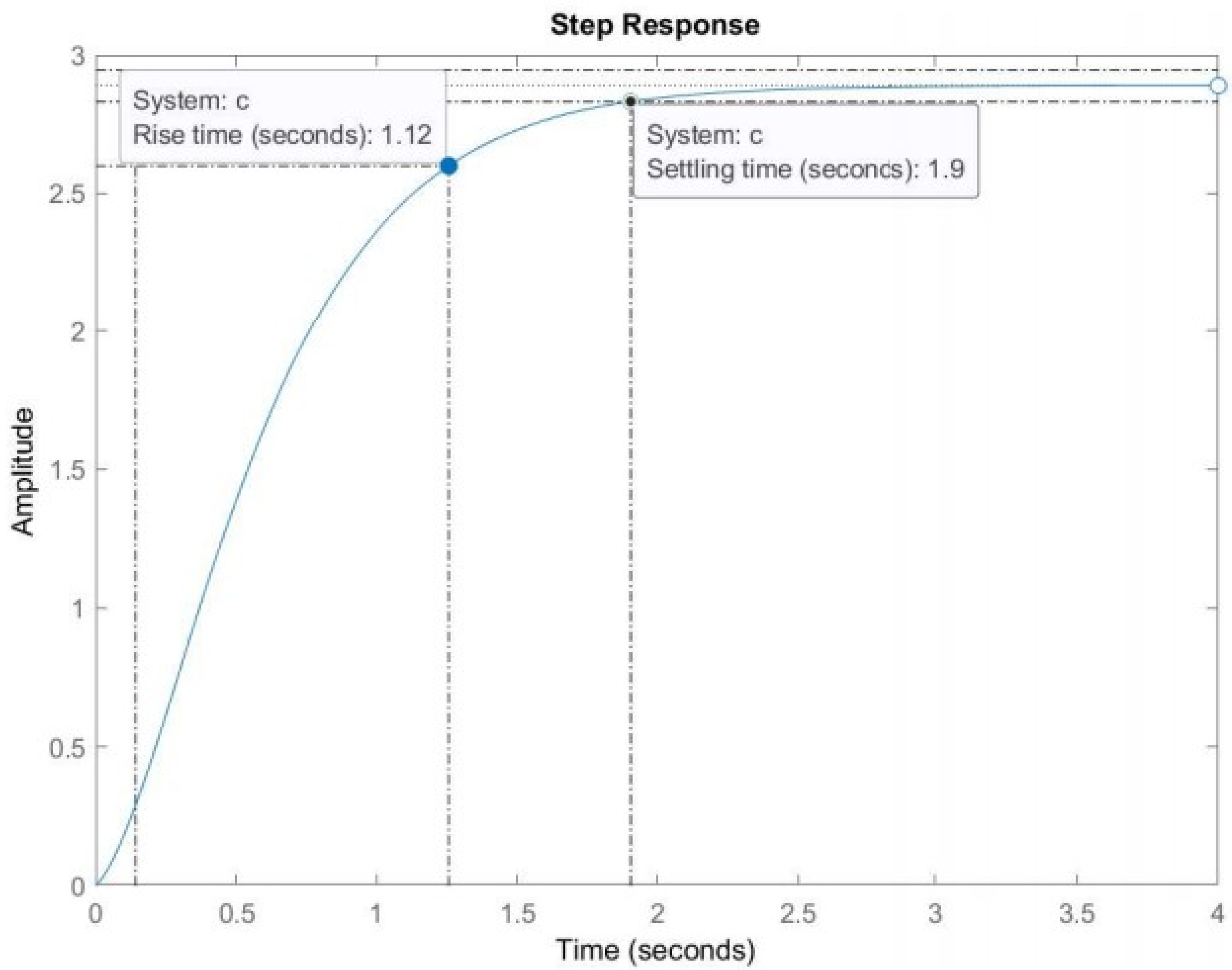
```
>> %%pole at R inverse
>> a=1/26

a =

    0.0385

>> z=[];
>> p=[-a+i*a,-a-i*a];
>> k=1000;
>> c=zpk(z,p,k)

c =

             1000
  ---------------------------
  (s^2 + 0.07692s + 0.002959)

Continuous-time zero/pole/gain model.

>> step(c);
>> stepinfo(c)

ans =

  struct with fields:

        RiseTime: 39.5069
    SettlingTime: 109.6239
     SettlingMin: 3.0536e+05
     SettlingMax: 3.5260e+05
       Overshoot: 4.3210
      Undershoot: 0
            Peak: 3.5260e+05
        PeakTime: 81.4194

>>
```


Ste
System: c
Peak amplitude: 3.53e+05
Overshoot (%): 4.32
At time (seconds): 81.4
System: c
Settling time (seconds): 110
System: c
Rise time (seconds): 39.5
$\times 10^5$
4
3.5
3
2.5
2
1.5
1
0.5
0
Amplitude
0
20
40
60
80
100
120
140
160
180
Time (seconds)

```
>> %%pole at 5R
>> r=26;
>> z=[];
>> k=1000;
>> a=5*r;
>> p=[-a+a*i,-a-a*i];
>> c=zpk(z,p,k)

c =

          1000
  ----------------------
  (s^2 + 260s + 3.38e04)

Continuous-time zero/pole/gain model.

>> step(c);
>> stepinfo(c)

ans =

  struct with fields:

        RiseTime: 0.0117
    SettlingTime: 0.0324
     SettlingMin: 0.0267
     SettlingMax: 0.0309
       Overshoot: 4.3210
      Undershoot: 0
            Peak: 0.0309
        PeakTime: 0.0241

>>
```

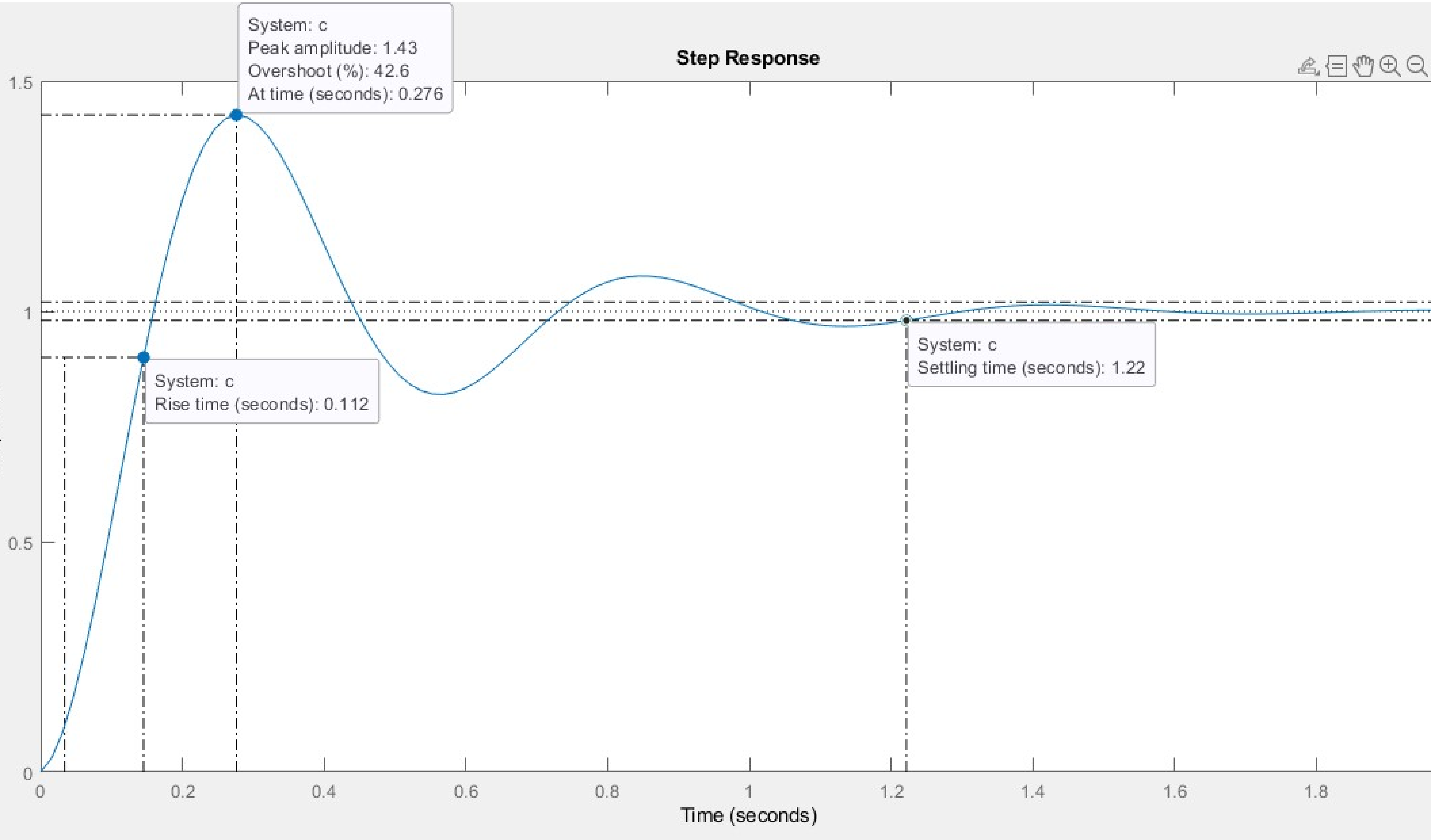

Step R
System: c
Peak amplitude: 0.0309
Overshoot (%): 4.32
At time (seconds): 0.0241
System: c
Settling time (seconds): 0.0324
System: c
Rise time (seconds): 0.0117
Amplitude
Time (seconds)
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0.045
0.05

```
>> %zero at R
>> n=[1 26];
>> d=[1 6 9];
>> c=tf(n,d)

c =

     s + 26
  -------------
  s^2 + 6 s + 9

Continuous-time transfer function.

>> step(c);
>> stepinfo(c)

ans =

  struct with fields:

        RiseTime: 1.1152
    SettlingTime: 1.9042
     SettlingMin: 2.6016
     SettlingMax: 2.8887
       Overshoot: 0
      Undershoot: 0
            Peak: 2.8887
        PeakTime: 4.1293

>>
```



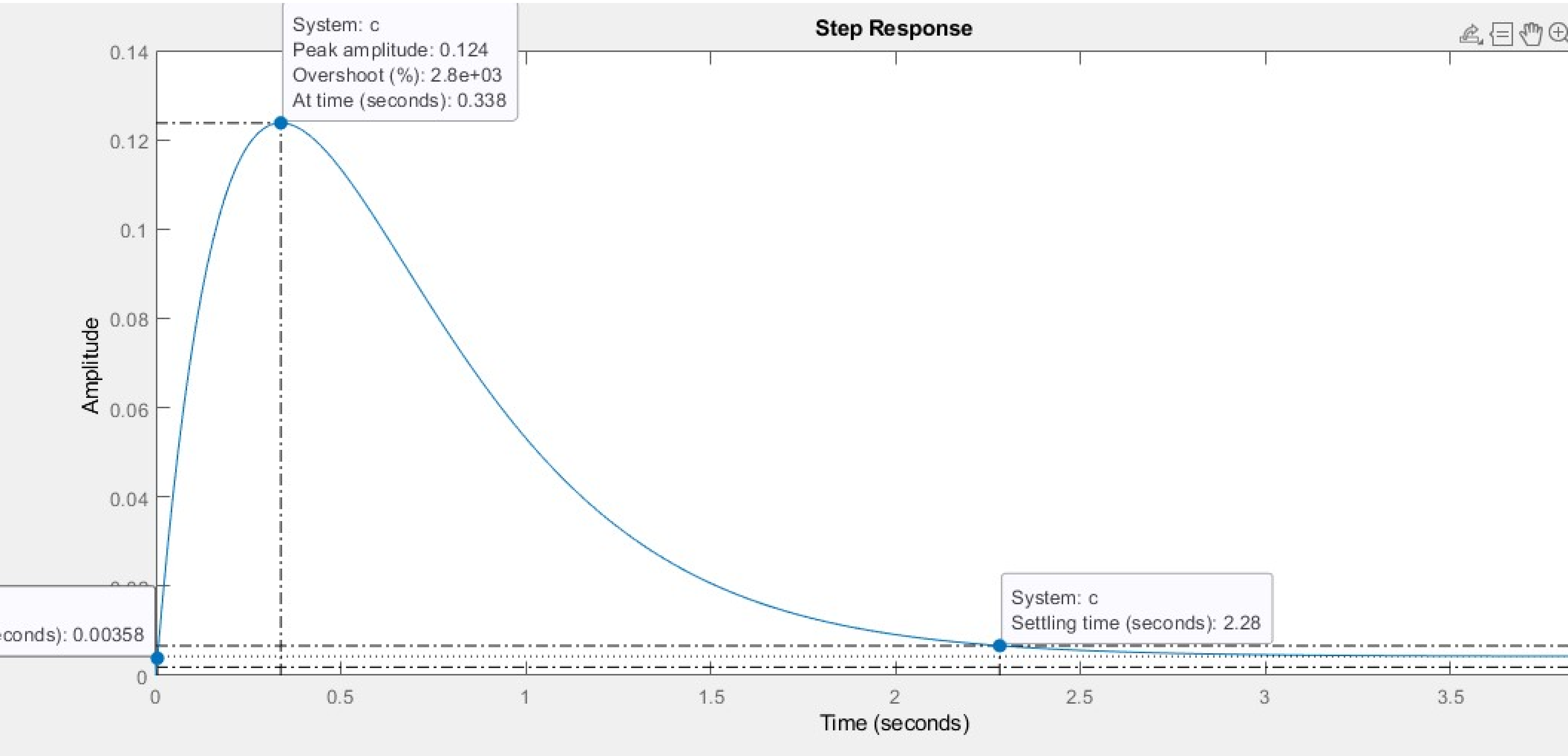
Step Response
System: c
Rise time (seconds): 1.12
System: c
Settling time (seconds): 1.9
Amplitude
Time (seconds)
0
0.5
1
1.5
2
2.5
3
3.5
4

```
>> %%zero at 5R
>> r=26;
>> a=5*r;
>> z=[1 a];
>> p=[1 6 a];
>> c=tf(z,p)

c =

      s + 130
  ---------------
  s^2 + 6 s + 130

Continuous-time transfer function.

>> step(c);
>> stepinfo(c)

ans =

  struct with fields:

        RiseTime: 0.1116
    SettlingTime: 1.2217
     SettlingMin: 0.8193
     SettlingMax: 1.4261
       Overshoot: 42.6143
      Undershoot: 0
            Peak: 1.4261
        PeakTime: 0.2763

>>
```



Step Response
System: c
Peak amplitude: 1.43
Overshoot (%): 42.6
At time (seconds): 0.276
System: c
Rise time (seconds): 0.112
System: c
Settling time (seconds): 1.22
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
Time (seconds)

```
>> %%zero at inverse R
>> r=1/26;
>> z=[1 r];
>> p=[1 6 9];
>> c=tf(z,p)

c =

    s + 0.03846
  -------------
  s^2 + 6 s + 9

Continuous-time transfer function.

>> step(c);
>> stepinfo(c)

ans =

  struct with fields:

        RiseTime: 0.0036
    SettlingTime: 2.2824
     SettlingMin: 0.0043
     SettlingMax: 0.1238
       Overshoot: 2.7961e+03
      Undershoot: 0
            Peak: 0.1238
        PeakTime: 0.3377

>>
```


Step Response
System: c
Peak amplitude: 0.124
Overshoot (%): 2.8e+03
At time (seconds): 0.338
System: c
Settling time (seconds): 2.28
conds): 0.00358
Amplitude
Time (seconds)
0.14
0.12
0.1
0.08
0.06
0.04
0
0.5
1
1.5
2
2.5
3
3.5