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Command Window

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```
>> %%step response of first order unity feedback system
>> %%G(s)=1/(s+29)
>> p=[0,1];
>> q=[1,29];
>> sys=tf(p,q)

sys =

    1
  ------
  s + 29

Continuous-time transfer function.

>> t=feedback(sys,1)

t =

    1
  ------
  s + 30

Continuous-time transfer function.

>> step(t);
>> title('step response of first order system')
>> stepinfo(sys)

ans =

  struct with fields:
```

Workspace

Name	Value
ans	1x1 struct
p	[0,1]
q	[1,29]
sys	1x1 tf
t	1x1 tf

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Command Window

New to MATLAB? See resources for Getting Started.

```
  Continuous-time transfer function.

>> t=feedback(sys,1)

t =

     1
  ------
  s + 30

  Continuous-time transfer function.

>> step(t);
>> title('step response of first order system')
>> stepinfo(sys)

ans =

  struct with fields:

        RiseTime: 0.0758
    SettlingTime: 0.1349
     SettlingMin: 0.0312
     SettlingMax: 0.0345
       Overshoot: 0
      Undershoot: 0
            Peak: 0.0345
        PeakTime: 0.3636

fx >>
```

Workspace

Name	Value
ans	1x1 struct
p	[0,1]
q	[1,29]
sys	1x1 tf
t	1x1 tf

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Figure 1

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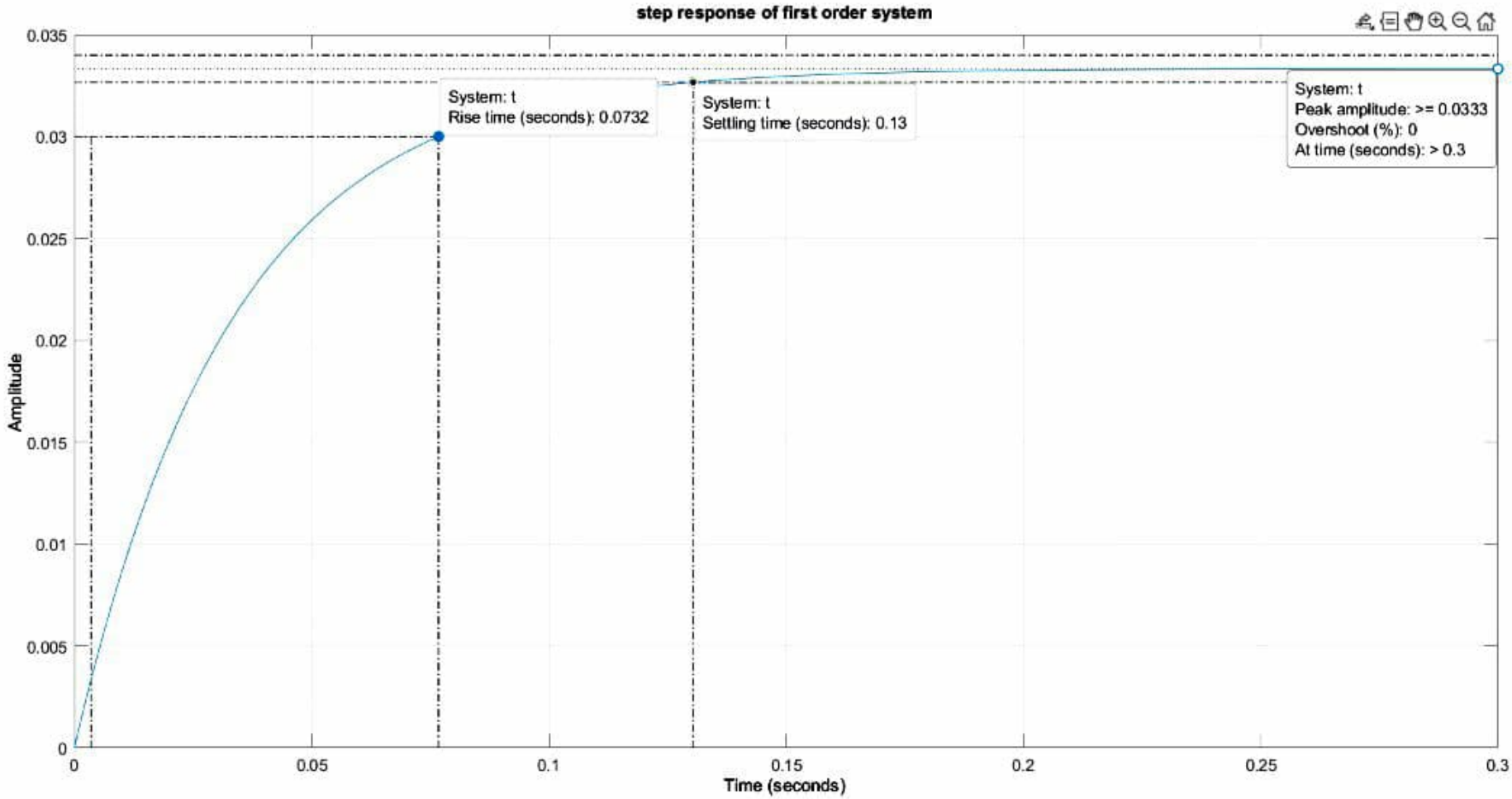

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Command Window

```
>> %%impulse response of first order unity feedback system
>> %%G(s)=1/(s+29)
>> p=[0,1];
>> q=[1,29];
>> sys=tf(p,q)

sys =

    1
  ------
  s + 29

Continuous-time transfer function.

>> t=feedback(sys,1)

t =

    1
  ------
  s + 30

Continuous-time transfer function.

>> impulse(t);
>> title('impulse responce of first order system')
fx >>
```

Workspace

Name	Value
p	[0,1]
q	[1,29]
sys	1x1 tf
t	1x1 tf

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Figure 1

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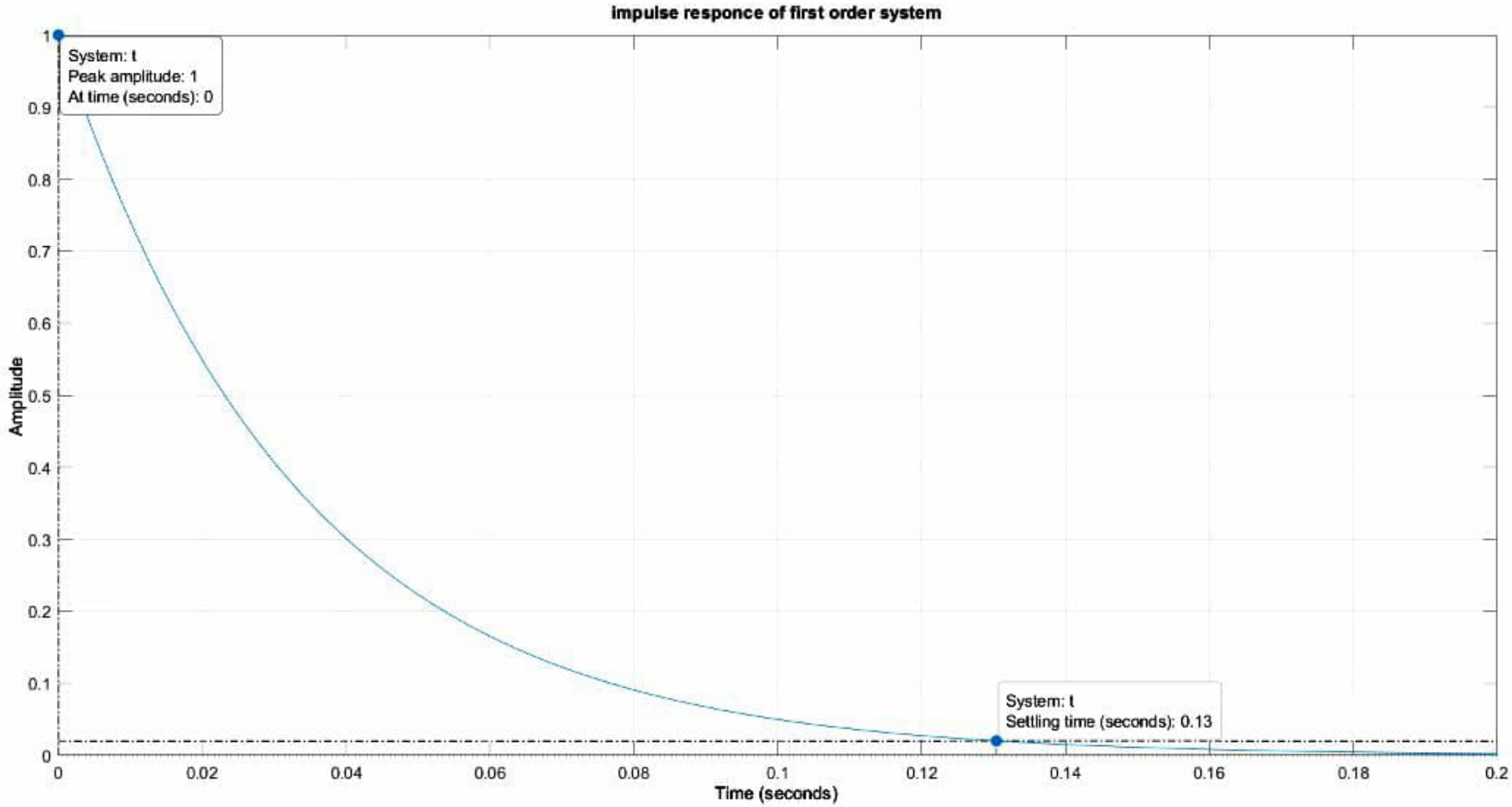

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Details

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Command Window

```
>> %%step response of second order system
>> %%G(s)=(w^2)/(s^2+2*e*w*s+w^2)
>> w=input('enter natural frequency')
enter natural frequency30

w =

    30

>> e=input('enter damping ratio')
enter damping ratio0.5

e =

    0.5000

>> p=[0,0,w*w];
>> q=[1,2*e*w,w*w];
>> sys=tf(p,q)

sys =

         900
  -----------------
  s^2 + 30 s + 900

Continuous-time transfer function.

>> step(sys);
>> title('step response of underdamped second order sys')
>> stepinfo(sys)
```

Workspace

Name	Value
ans	1x1 struct
e	0.5000
p	[0,0,900]
q	[1,30,900]
sys	1x1 tf
w	30

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Figure 1

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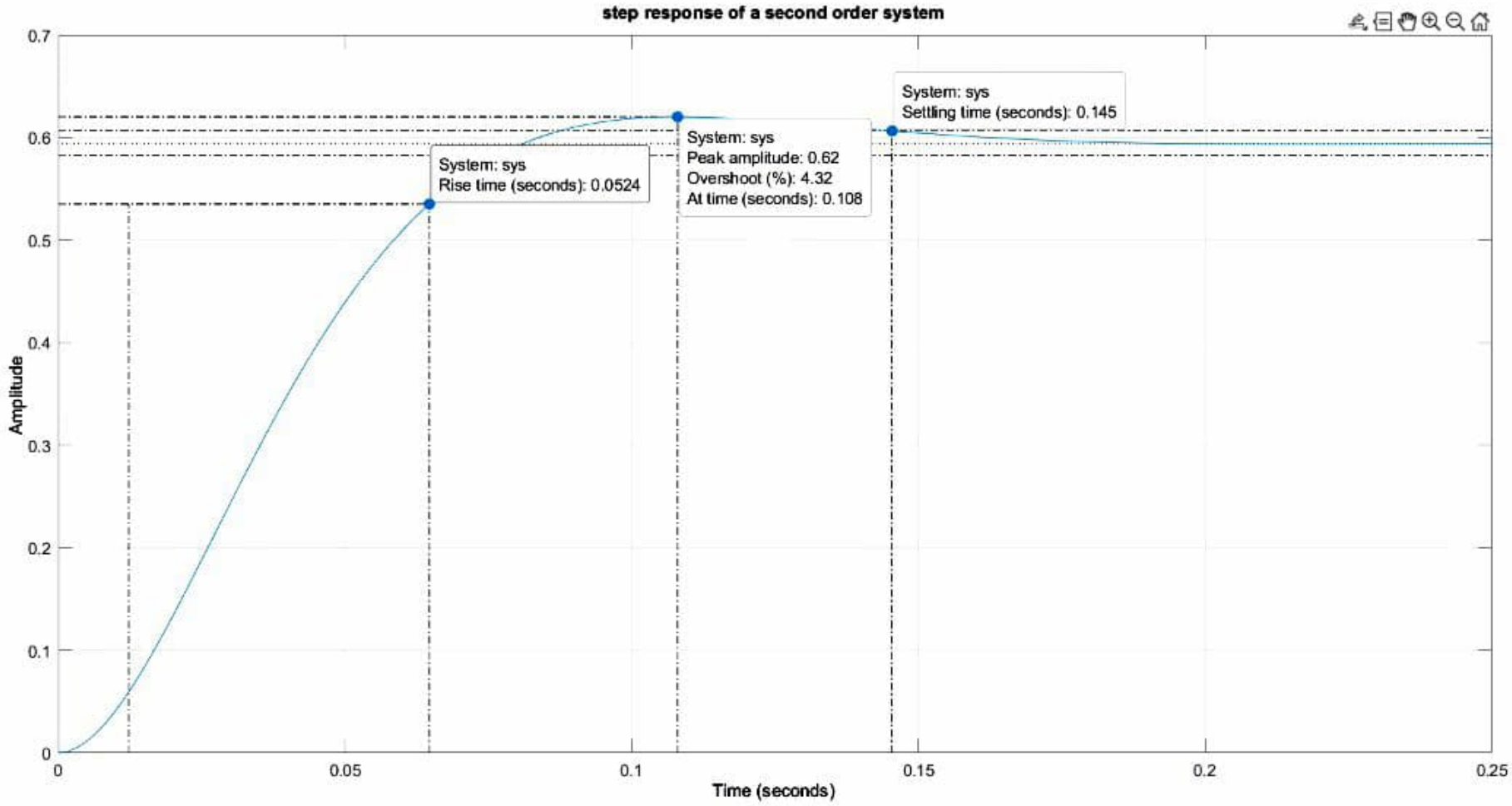

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Command Window

```
      0.5000

>> p=[0,0,w*w];
>> q=[1,2*e*w,w*w];
>> sys=tf(p,q)

sys =

          900
  -----------------
  s^2 + 30 s + 900

Continuous-time transfer function.

>> step(sys);
>> title('step response of underdamped second order sys')
>> stepinfo(sys)

ans =

  struct with fields:

        RiseTime: 0.0546
    SettlingTime: 0.2692
     SettlingMin: 0.9315
     SettlingMax: 1.1629
       Overshoot: 16.2929
      Undershoot: 0
            Peak: 1.1629
        PeakTime: 0.1197

fx >>
```

Workspace

Name	Value
ans	1x1 struct
e	0.5000
p	[0,0,900]
q	[1,30,900]
sys	1x1 tf
w	30

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Figure 1

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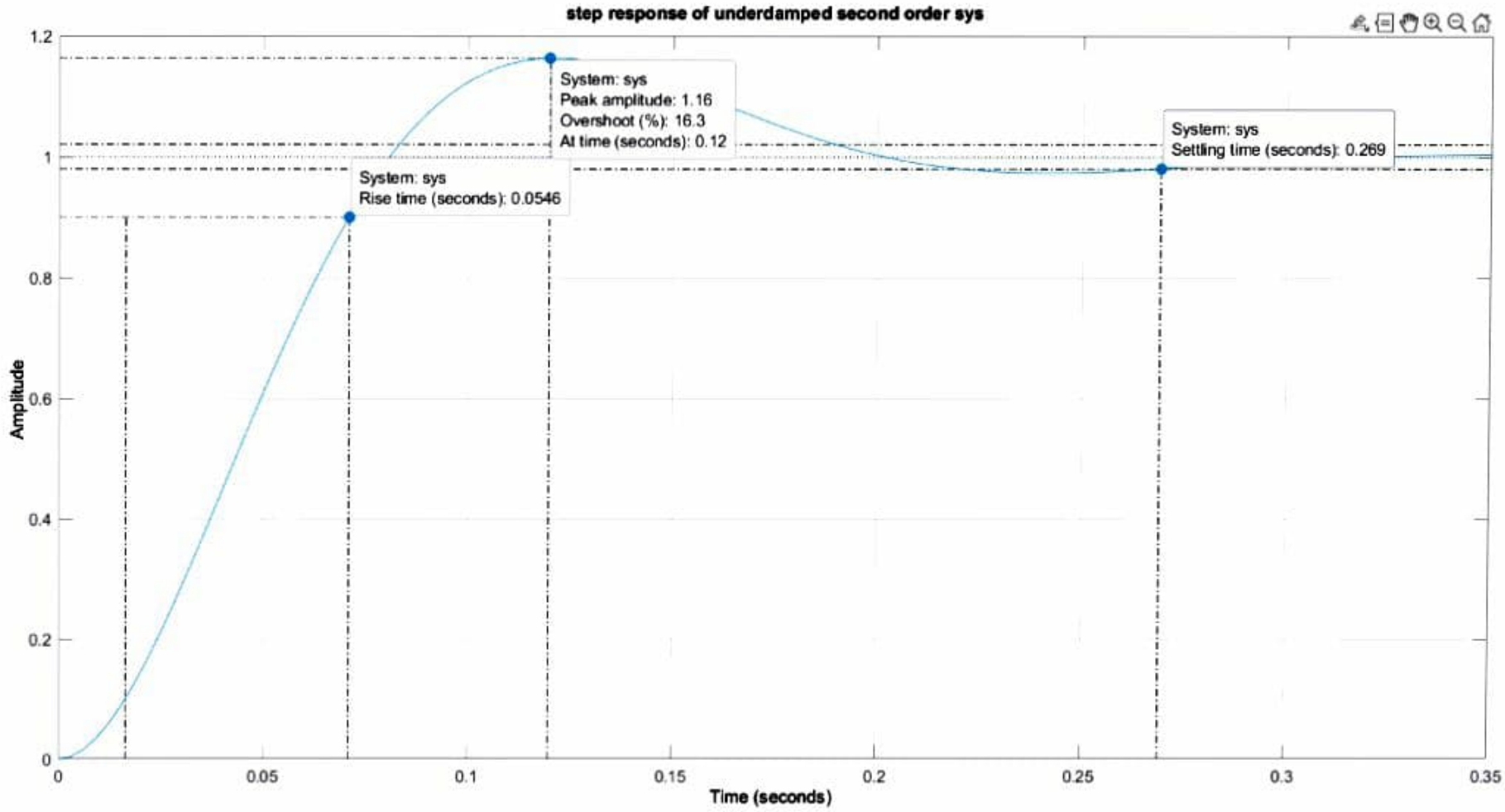

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Command Window

```
>> %%step response of second order system
>> %%G(s)=w^2/(s^2+2*e*w+w^2
>> w=input('enter natural frequency')
enter natural frequency30

w =

    30

>> e=input('enter damping ratio')
enter damping ratio2

e =

     2

>> p=[0,0,w^2];
>> q=[1,2*e*w,w*w];
>> sys=tf(p,q)

sys =

          900
  -----------------
  s^2 + 120 s + 900

Continuous-time transfer function.

>> step(sys);
>> title('step response of overdamped second order system')
fx >>
```

Workspace

Name	Value
ans	*1x1 struct*
e	2
p	[0,0,900]
q	[1,120,900]
sys	*1x1 tf*
w	30

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Command Window

```
     2

>> p=[0,0,w^2];
>> q=[1,2*e*w,w*w];
>> sys=tf(p,q)

sys =

         900
  -----------------
  s^2 + 120 s + 900

Continuous-time transfer function.

>> step(sys);
>> title('step response of overdamped second order system')
>> stepinfo(sys)

ans =

  struct with fields:

        RiseTime: 0.2744
    SettlingTime: 0.4960
     SettlingMin: 0.9017
     SettlingMax: 0.9993
       Overshoot: 0
      Undershoot: 0
            Peak: 0.9993
        PeakTime: 0.9109

fx >>
```

Workspace

Name	Value
ans	1x1 struct
e	2
p	[0,0,900]
q	[1,120,900]
sys	1x1 tf
w	30

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Figure 1

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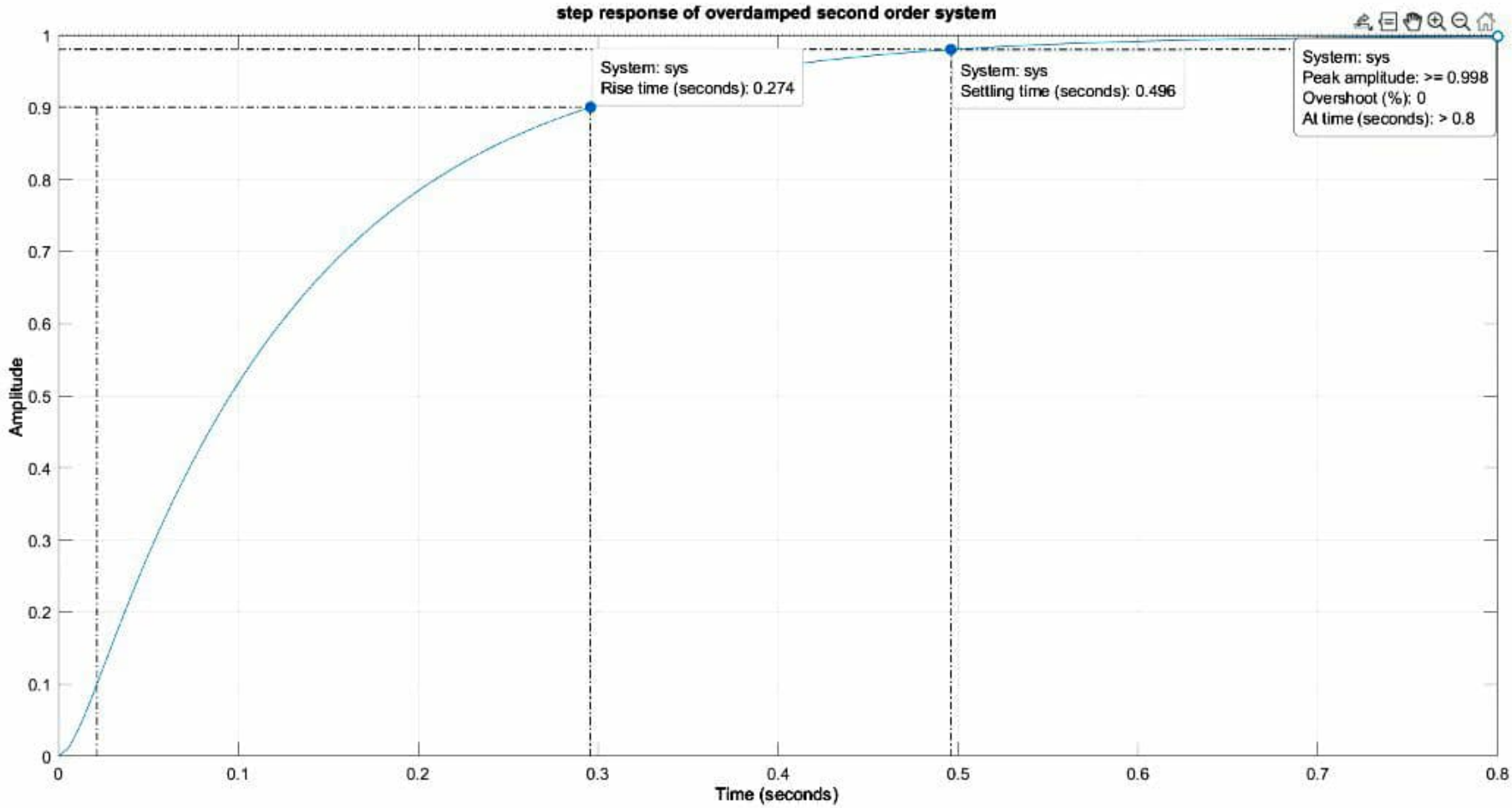

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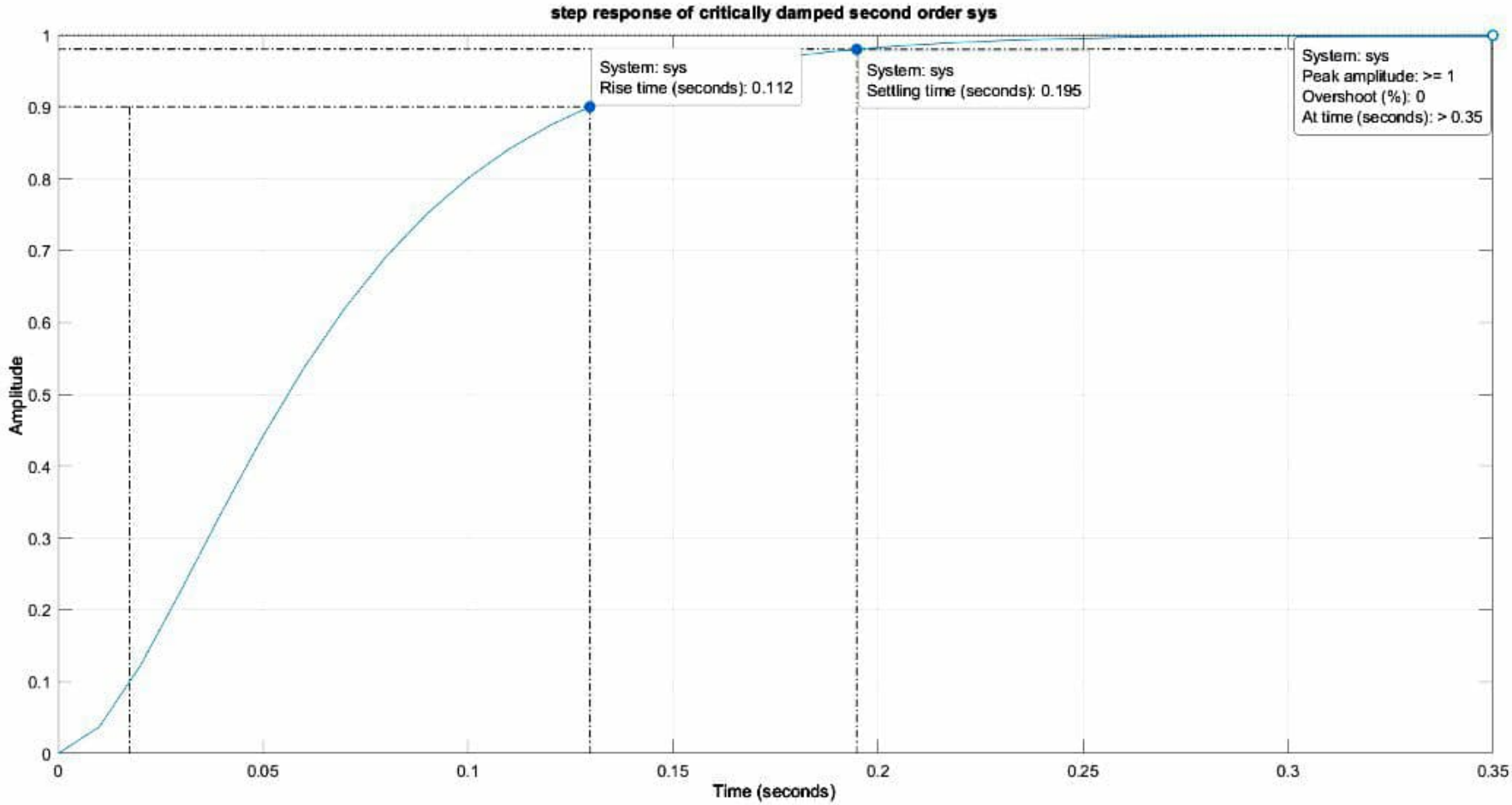

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Command Window

```
>>  %%effect of poles and zeroes
>> z=[];
>> p=[-29+29i,-29-29i];
>> k=1000;
>> sys=zpk(z,p,k)

sys =

         1000
  ------------------
  (s^2 + 58s + 1682)

Continuous-time zero/pole/gain model.

>> figure(1);
>> step(sys);
>> title('step response of a second order system');
>> %%addition of pole at -1/29
>> z=[];
>> p=[-29+29i,-29-29i,-1/29];
>> k=1000;
>> sys1=zpk(z,p,k)

sys1 =

              1000
  -----------------------------
  (s+0.03448) (s^2 + 58s + 1682)

Continuous-time zero/pole/gain model.

>> figure(2);
```

Workspace

Name	Value
k	1000
p	[-29.0000 + 29.0...
sys	1x1 zpk
sys1	1x1 zpk
sys2	1x1 zpk
sys3	1x1 zpk
z	-1

Continue entering statement

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Figure 2

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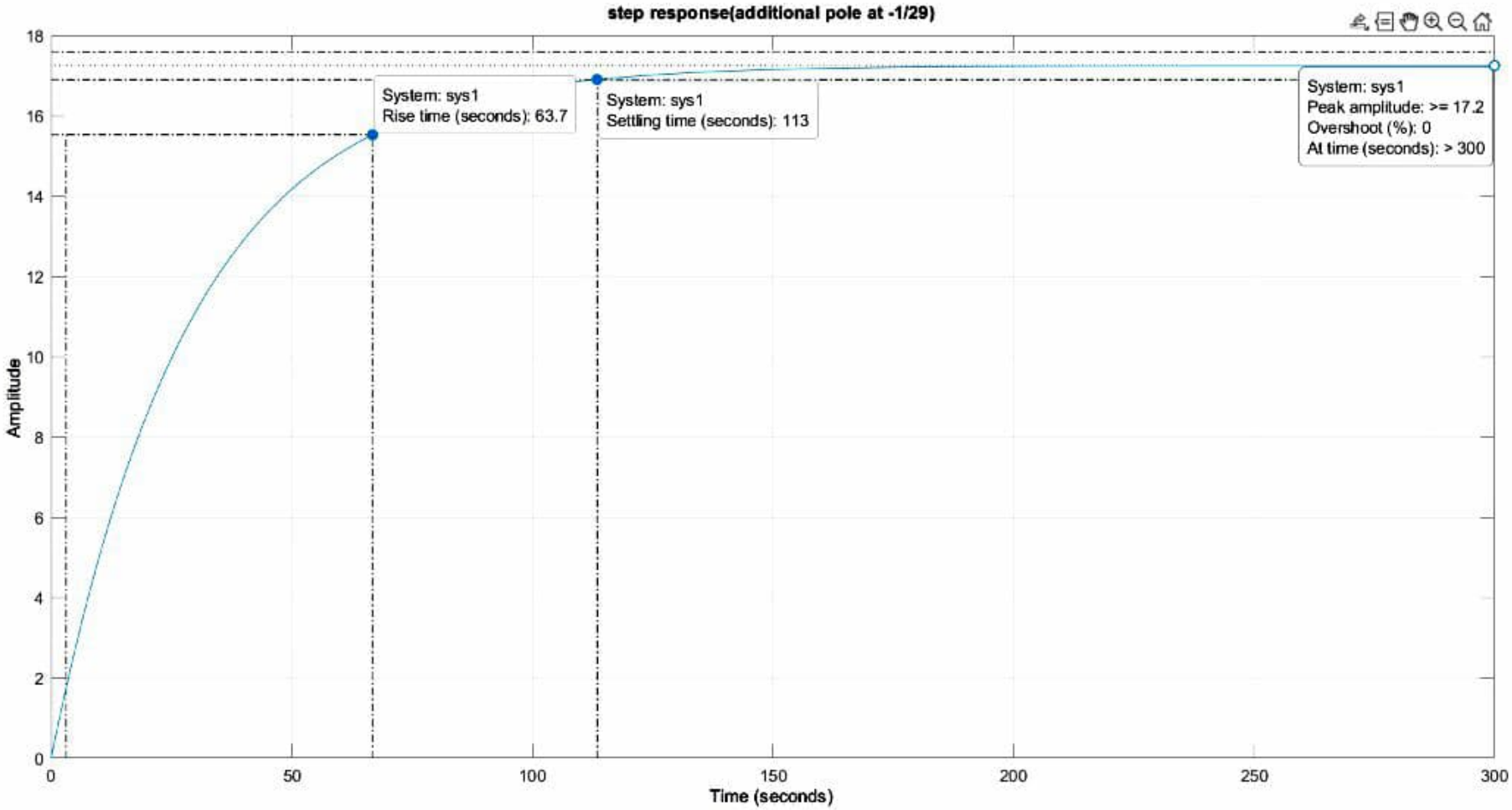

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Command Window

```
>> figure(2);
>> step(sys1);
>> title('step response(additional pole at -1/29)')
>> %%addition of pole at -29
>> z=[];
>> p=[-29+29i,-29-29i,-29];
>> k=1000;
>> sys2=zpk(z,p,k)

sys2 =

           1000
  ------------------------
  (s+29) (s^2 + 58s + 1682)

Continuous-time zero/pole/gain model.

>> figure(3);
>> step(sys2);
>> title('step response(additional pole at -29)')
>> %%addition of pole at -145
>> z=[];
>> p=[-29+29i,-29-29i,-145];
>> k=1000;
>> sys3=zpk(z,,k)
 sys3=zpk(z,,k)
             ↑
Error: Invalid expression. When calling a function or indexing a variable, use parentheses. Otherwise, check for
mismatched delimiters.

>> sys3=zpk(z,p,k)
```

Workspace

Name	Value
k	1000
p	[-29.0000 + 29.0...
sys	1x1 zpk
sys1	1x1 zpk
sys2	1x1 zpk
sys3	1x1 zpk
z	-1

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Command Window

```
    (s+29) (s^2 + 58s + 1602)

Continuous-time zero/pole/gain model.

>> figure(3);
>> step(sys2);
>> title('step response(additional pole at -29)')
>> %%addition of pole at -145
>> z=[];
>> p=[-29+29i,-29-29i,-145];
>> k=1000;
>> sys3=zpk(z,,k)
 sys3=zpk(z,,k)
           ↑
Error: Invalid expression. When calling a function or indexing a variable, use parentheses. Otherwise, check for
mismatched delimiters.

>> sys3=zpk(z,p,k)

sys3 =

            1000
  -------------------------
  (s+145) (s^2 + 58s + 1682)

Continuous-time zero/pole/gain model.

>> figure(4);
>> step(sys3);
>> title('step response(additional pole at -145)');
>> %%addition of zero at -1/29
>> z=[-1];
```

Workspace

Name	Value
k	1000
p	[-29.0000 + 29.0...
sys	1x1 zpk
sys1	1x1 zpk
sys2	1x1 zpk
sys3	1x1 zpk
z	-1

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Figure 6

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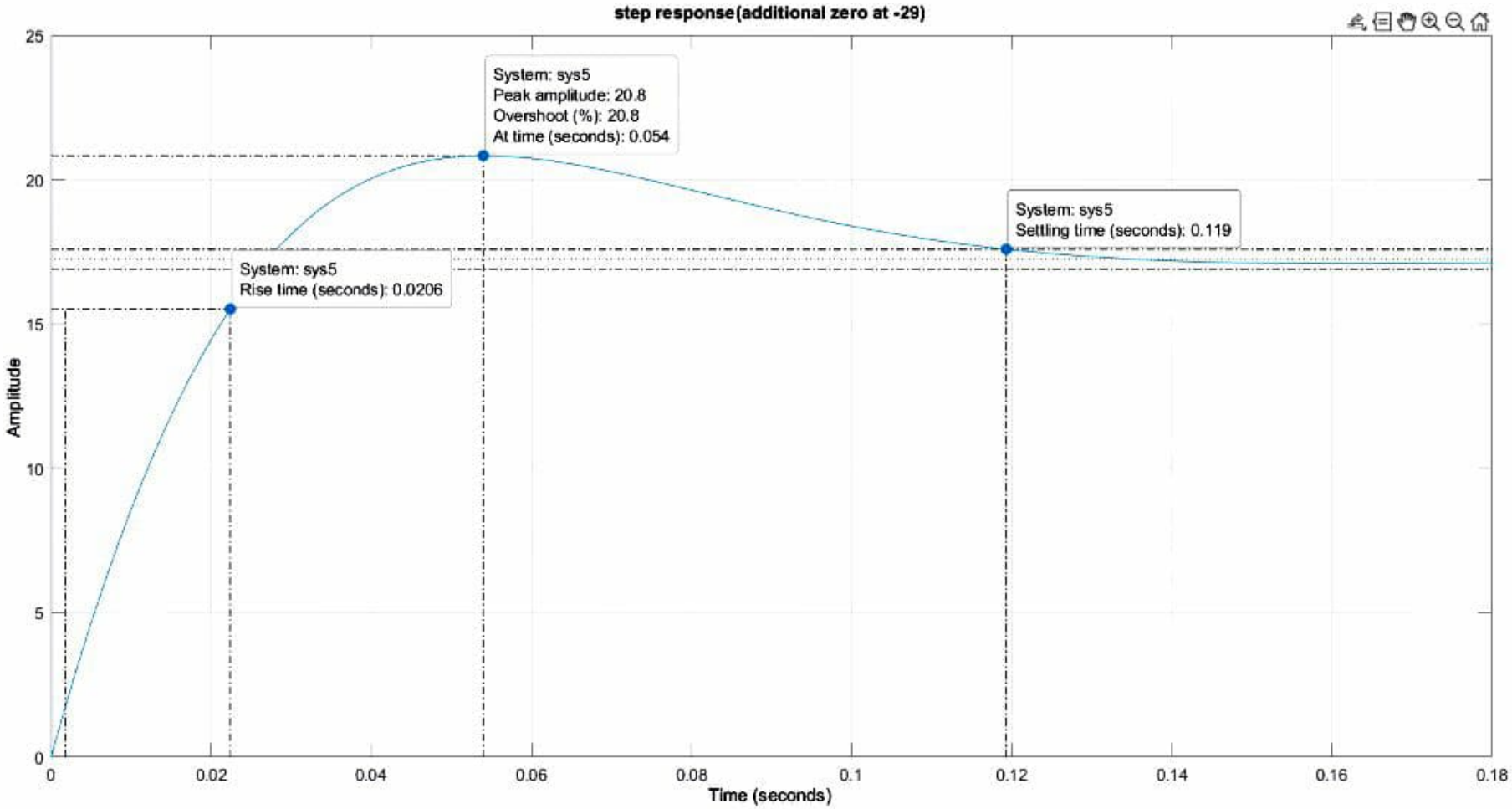

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Figure 7

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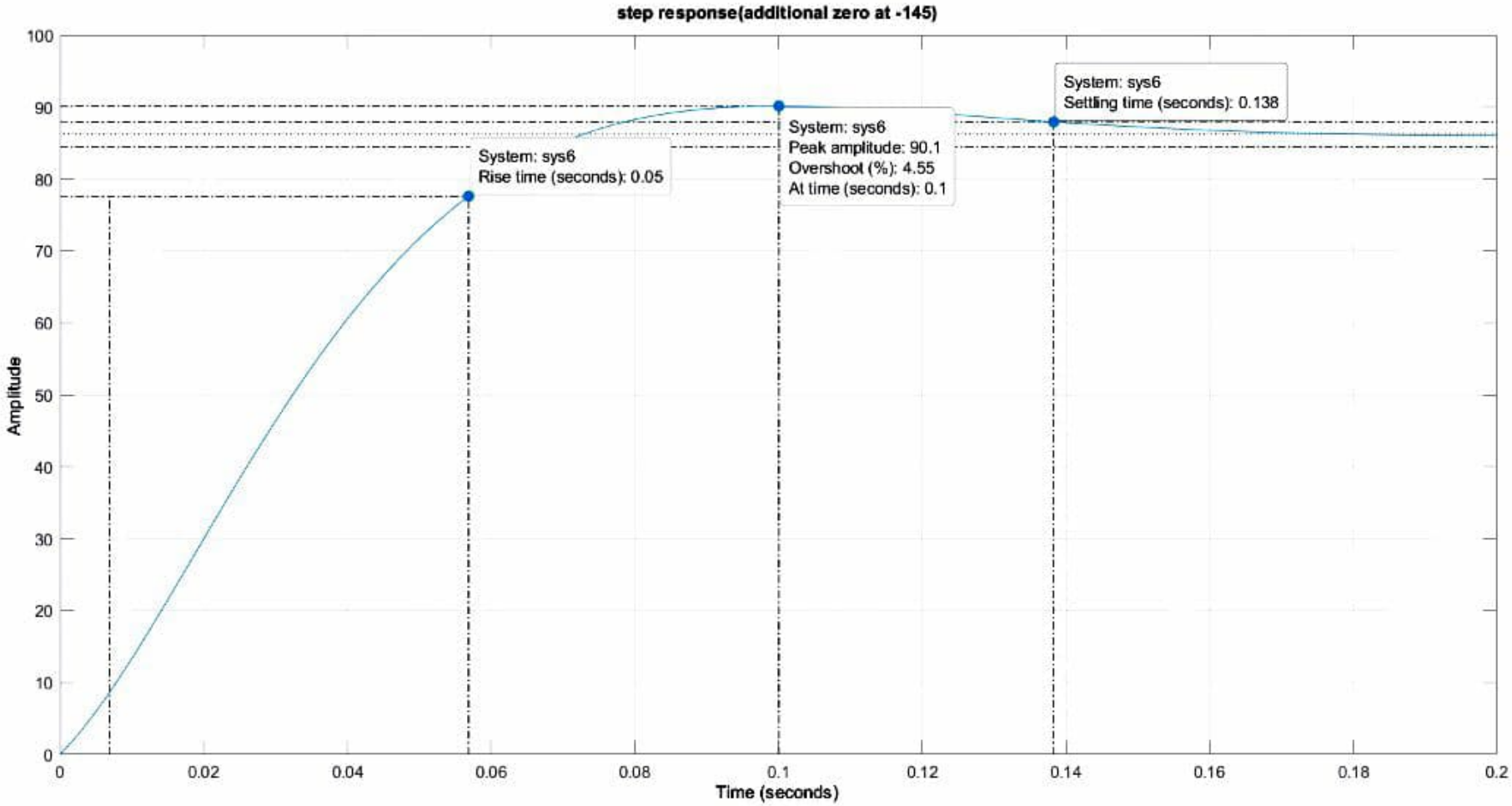

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Command Window

```
>> %%addition of zero at -1/29
>> z=[-1/29];
>> p=[-29+29i,-29-29i];
>> k=1000;
>> sys4=zpk(z,p,k)

sys4 =

   1000 (s+0.03448)
  ------------------
  (s^2 + 58s + 1682)

Continuous-time zero/pole/gain model.

>> figure(5);
>> step(sys4);
>> title('step response(additional zero at -1/29)');
>> %%addition of zero at -29
>> z=[-29];
>> p=[-29+29i,-29-29i];
>> k=1000;
>> sys5=zpk(z,p,k)

sys5 =

     1000 (s+29)
  ------------------
  (s^2 + 58s + 1682)

Continuous-time zero/pole/gain model.

>> figure(6);
```

Workspace

Name	Value
k	1000
p	[-29.0000 + 29.0...
sys4	1x1 zpk
sys5	1x1 zpk
sys6	1x1 zpk
z	-145

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Figure 5

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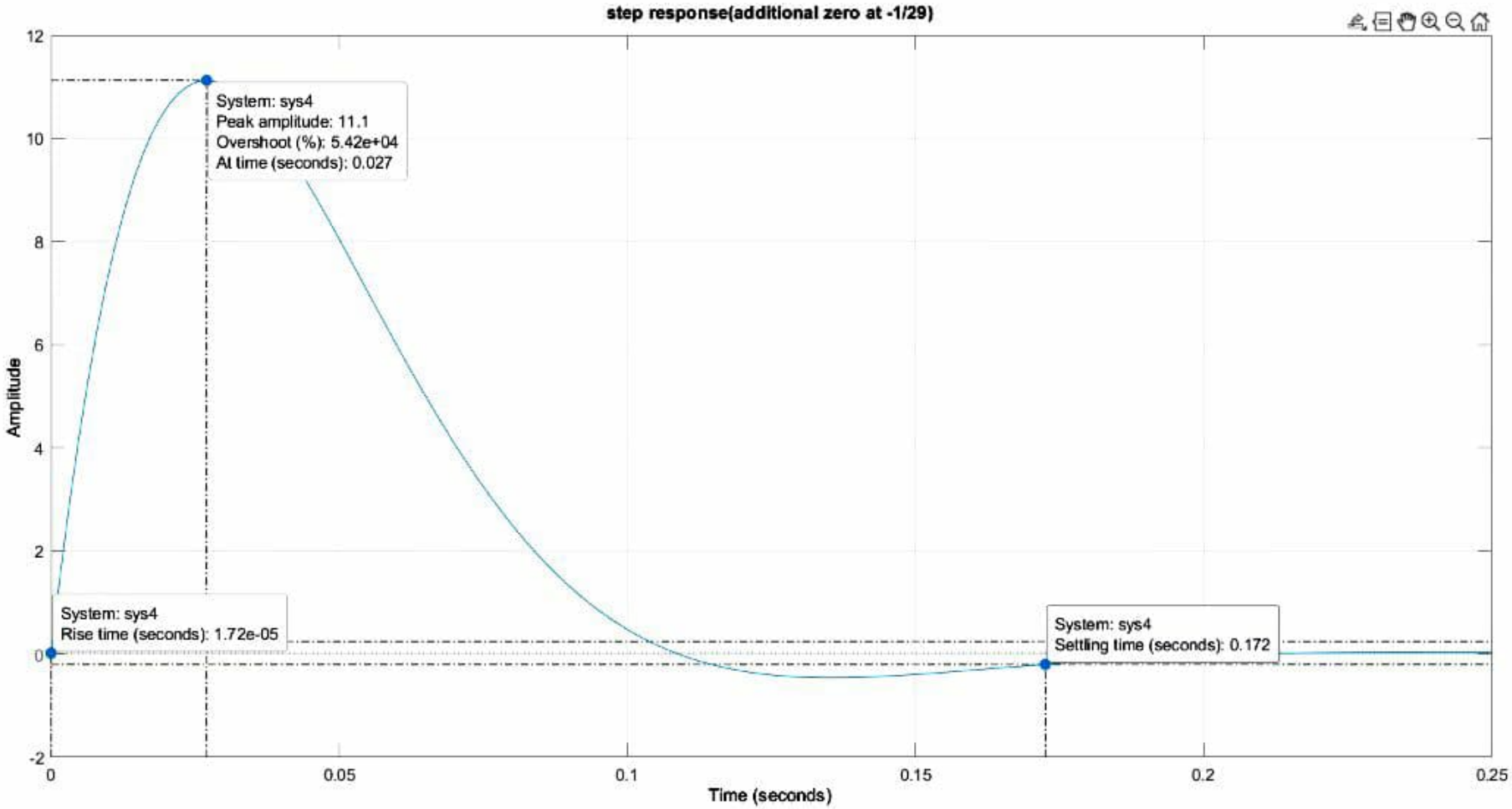

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Figure 3

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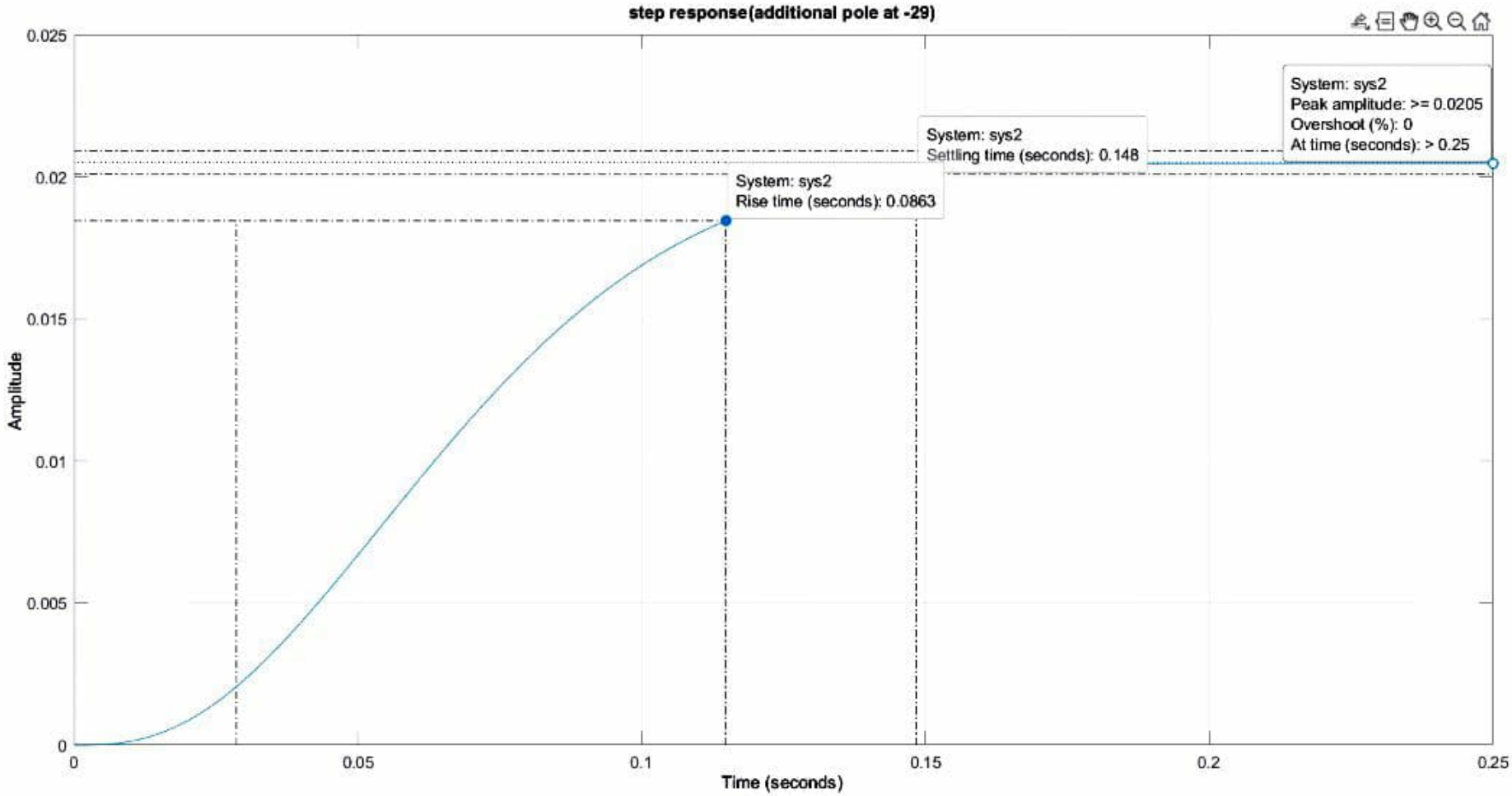

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Command Window

```
>> k=1000;
>> sys5=zpk(z,p,k)

sys5 =

        1000 (s+29)
  ------------------
  (s^2 + 58s + 1682)

Continuous-time zero/pole/gain model.

>> figure(6);
>> step(sys5);
>> title('step response(additional zero at -29)')
>> %%addition of zero at -145
>> z=[-145];
>> p=[-29+29i,-29-29i];
>> k=1000;
>> sys6=zpk(z,p,k)

sys6 =

        1000 (s+145)
  ------------------
  (s^2 + 58s + 1682)

Continuous-time zero/pole/gain model.

>> figure(7);
>> step(sys6);
>> title('step response(additional zero at -145)');
fx >>
```

Workspace

Name	Value
k	1000
p	[-29.0000 + 29.0...
sys4	1x1 zpk
sys5	1x1 zpk
sys6	1x1 zpk
z	-145

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Figure 4

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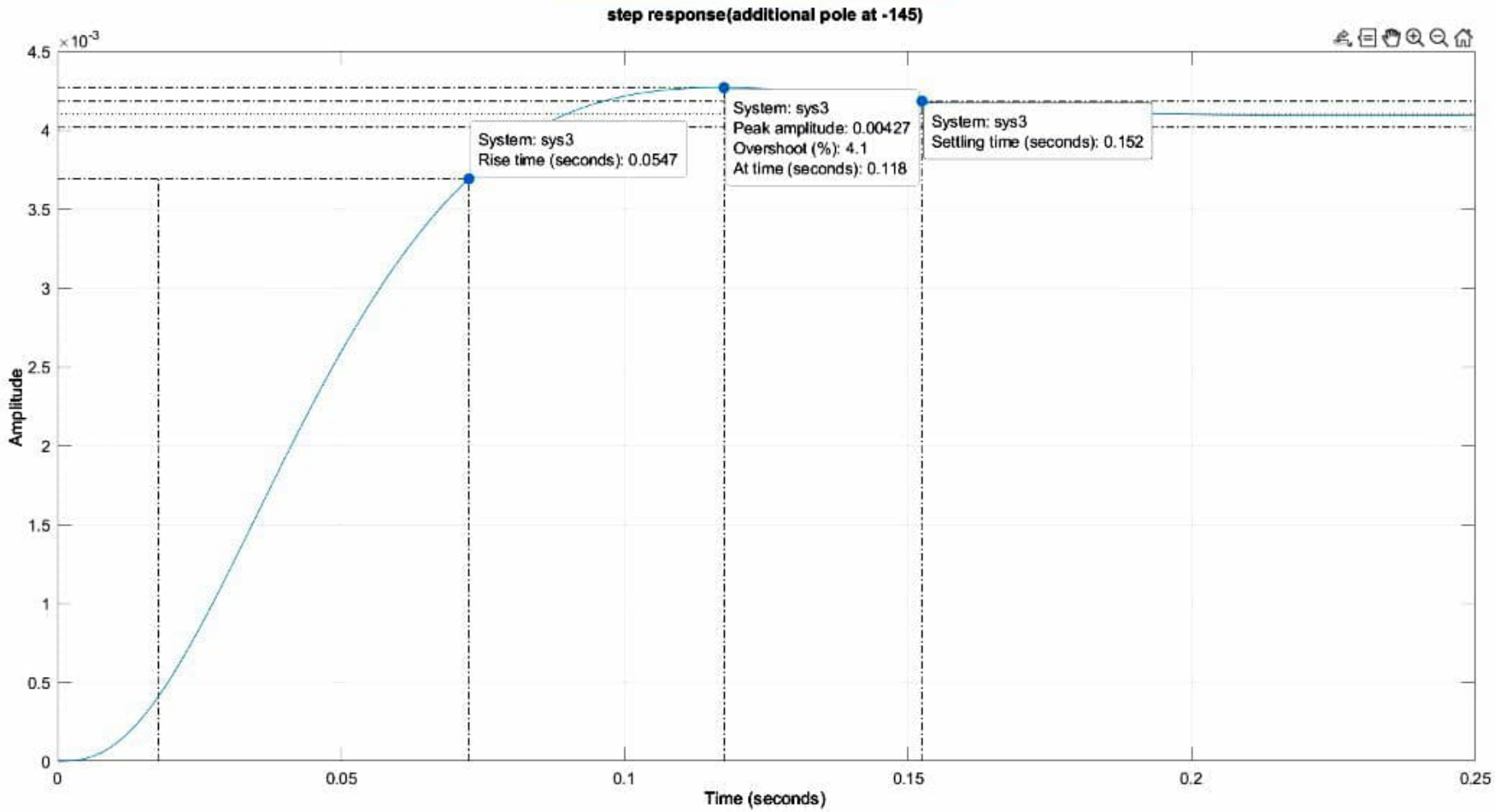

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