# Scilab Manual for
# Control Systems & Electrical Machines
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# Experiment: 1

# To plot pole zero plot of given system and comment on stability

**Scilab code Solution 1.01** polezeroplot

```
1 //exp1 find pole zero plot of given transfer
     functions
2 //OS=Windows XP sp3
3 //Scilab version 5.4.0
4 //sample values
5 s=poly(0,'s');
6 n=[2+3*s+4*s^2];//input numerator of transfer
     function
7 d=[1+s+s^2];//input denomenator of transfer function
8 h=syslin('c',n/d);
9 plzr(h);
```

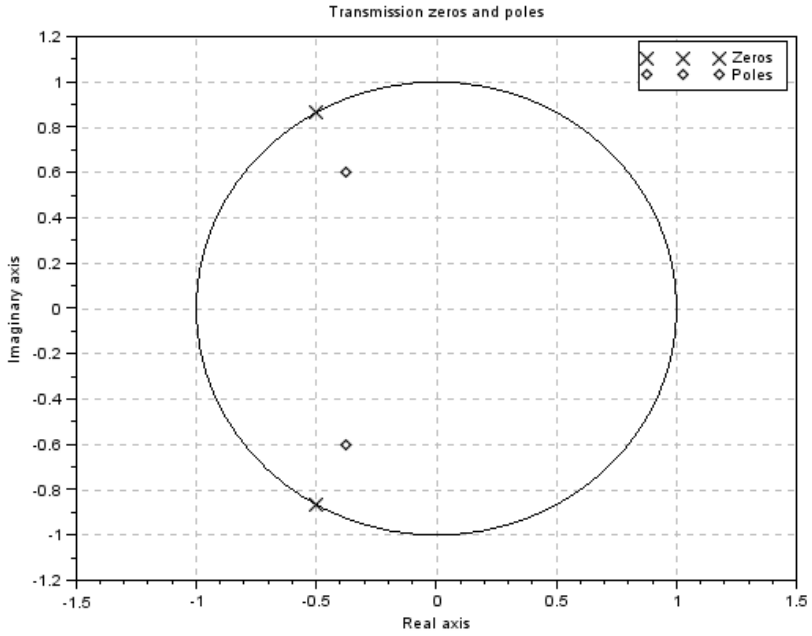


Figure 1.1: polezeroplot

# Experiment: 2

# To study transient response for given system

**Scilab code Solution 2.02** transientresponse

```
1 //          2 To study transient response for given
     system1
2 //OS=Windows XP sp3
3 //Scilab version 5.4.0
4 //sample values
5 s=%s
6 //('Enter the value of damping z for under damped
     system')
7 z=0.9
8 num=1;den =36+2*z*s+s^2;//input numerator and
     denomenator of transfer function
9 TF = syslin('c',num,den)//transfer function
10 //disp(TF)
11 subplot(131)
12 t=0:0.1:10;
13 y1 = csim('step', t, TF);//time response
14 title('Underdamped system');
15 plot(t, y1)
16 //('Enter the value of damping z for critically
```

```
    damped system')
z=6
num=1;den =36+2*z*s+s^2;
TF = syslin('c',num,den)
subplot(132)
t=0:0.1:10;
y1 = csim('step', t, TF);
title('Critically damped system');
plot(t, y1)
//('Enter the value of damping z for over damped
    system')
z=20
num=1;den =36+2*z*s+s^2;
TF = syslin('c',num,den)
subplot(133)
t=0:0.1:10;
y1 = csim('step', t, TF);
title('Overdamped system');
plot(t, y1)
```

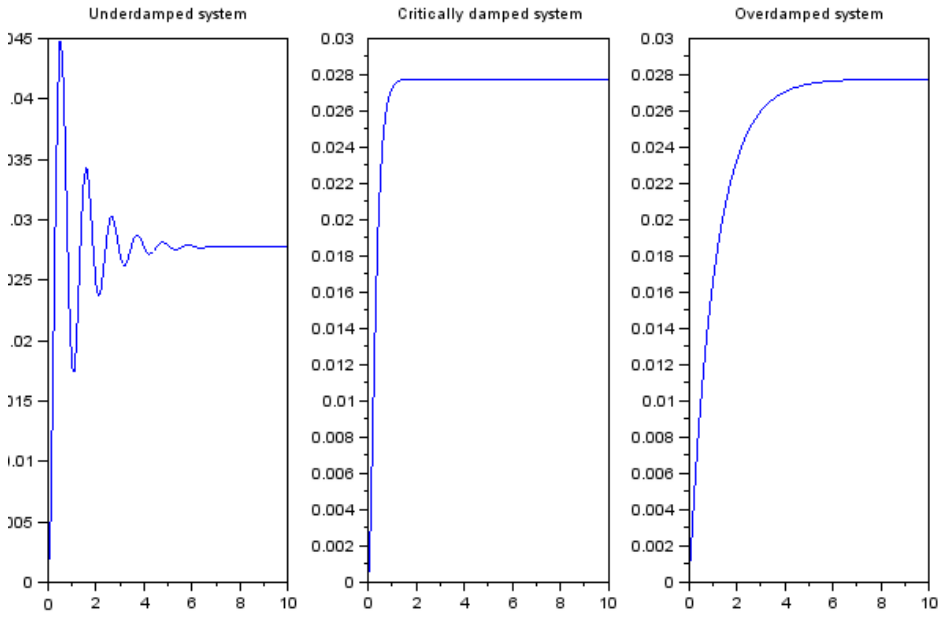


Figure 2.1: transientresponse

# Experiment: 3

# To sketch root locus, bode plot and nyquist plot for given system

**Scilab code Solution 3.03** stabilityanalysis

```
1 //3 To sketch root locus , bode plot and nyquist
     plot for given system
2 //OS=Windows XP sp3
3 //Scilab version 5.4.0
4 //sample values
5 s=%s ;
6 T=syslin('c',25+30*s+5*s^2,168+206*s+89*s^2+16*s^3+s
     ^4);//transfer function
7 subplot(131)
8 title('Bode plot')
9 bode(T) //  bode plot
10 subplot(132)
11 nyquist(T) //  nyquist plot
12 subplot(133)
13 evans(T); //rootlocus
```

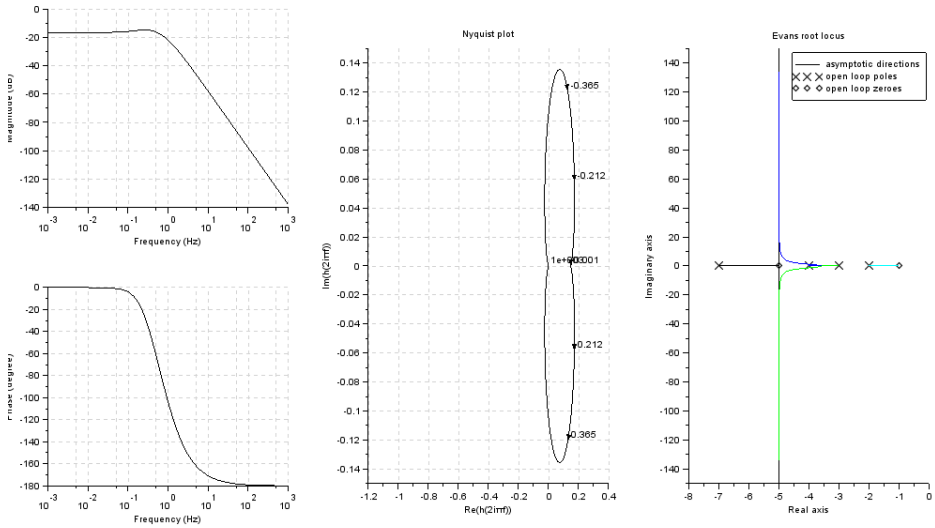


Figure 3.1: stabilityanalysis

# Experiment: 4

# To compare open loop and closed loop system.

**Scilab code Solution 4.04** systemcomparison

```
1  //  4 To compare open loop and closed loop system.
2  //OS=Windows XP sp3
3  //Scilab version 5.4.0
4  //sample values
5     s=%s
6  z=0.1
7  num=1;den =36+2*z*s+s^2;//input numerator and
      denomenator of transfer function
8  TF = syslin('c',num,den)//transfer function of
      system
9  disp(TF)
10 subplot(121)
11 t=0:0.1:30;
12 y1 = csim('step', t, TF);//transisent response
13 title('Open Loop system');
14 plot(t, y1)
15 s=%s
16 num1=s;den1 =1+s;
17 TF1 = syslin('c',num1,den1)
```

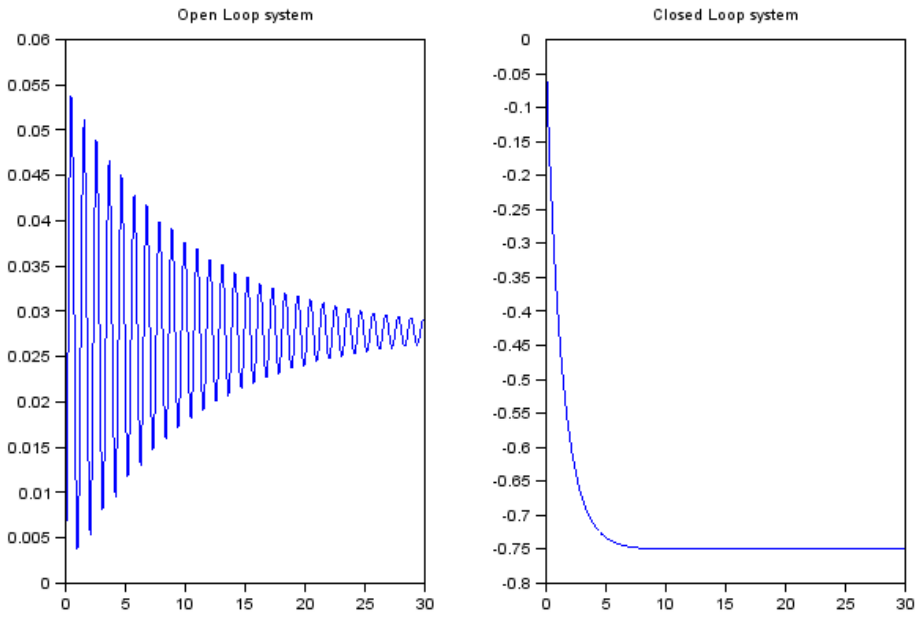


Figure 4.1: systemcomparison

```
18 num2=1;den2 =3;
19 TF2 = syslin('c',num2,den2)
20 S1=TF1/.TF2
21 disp(S1)
22 subplot(122)
23 t=0:0.1:30;
24 y1 = csim('step', t, S1);
25 title('Closed Loop system');
26 plot(t, y1)
```

This code can be downloaded from the website wwww.scilab.in

# Experiment: 5

# To use block reduction technique to get the equivalent system

**Scilab code Solution 5.05** blockreduction

```
1 //          5 To use block reduction technique to get
      the equivalent system
2 // this is is a typical case where for given block
     daigram where h3 and h4 form a loop which is in
     series to h1 and h3 is negative feedback to the
     combination
3 //OS=Windows XP sp3
4 //Scilab version 5.4.0
5 //sample values
6 clc
7 s=poly(0,'s');
8 n1=[2*s];//input numerator and denomenator of
     transfer function
9 d1=[3+s^2];
10 h1=syslin('c',n1/d1); //transient response
11 n2=[2];
12 d2=[s+4];
```

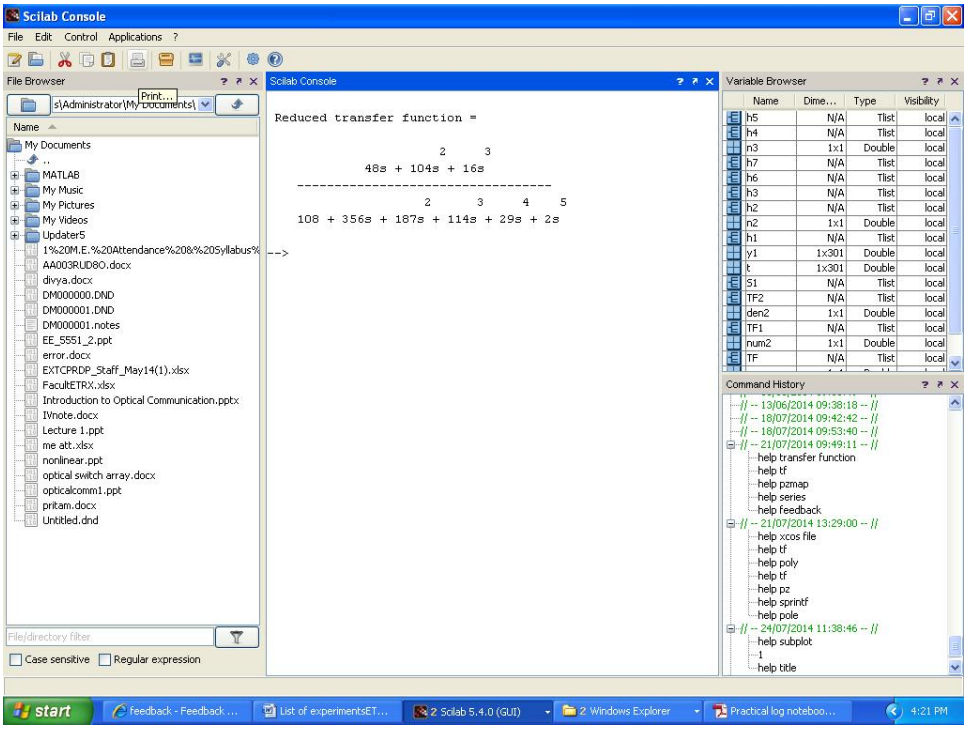


Figure 5.1: blockreduction

```
13 h2=syslin('c',n2/d2);
14 n3=[4];
15 d3=[s+6];
16 h3=syslin('c',n3/d3);
17 n4=[s];
18 d4=[1+2*s];
19 h4=syslin('c',n4/d4);
20 h5=h3/.h4
21 h6=h1*h5
22 h7=h6/.h3
23 disp(h7, "Reduced transfer function =")
```

# Experiment: 6

# To implement state model reduction technique for the given system

**Scilab code Solution 6.06** statemodel

```
1  //          6 To implement state model reduction
       technique for the given system
2  //OS=Windows XP sp3
3  //Scilab version 5.4.0
4  //sample values
5  clc
6  clear all
7  s=poly(0,'s');
8  X1=[0 1;-6 -5];//X1, X2 X3 represent A B C matrix of
       state space repesentation
9  X2=[0 ; 1];
10 X3=[8 1 ]
11 [n1, n2] = size(X1)
12 I=eye(n1,n2)//identity matrix
13 X=s*I-X1
14 phi=inv(X)//inverse of matrix
15 Y=X3*phi
```

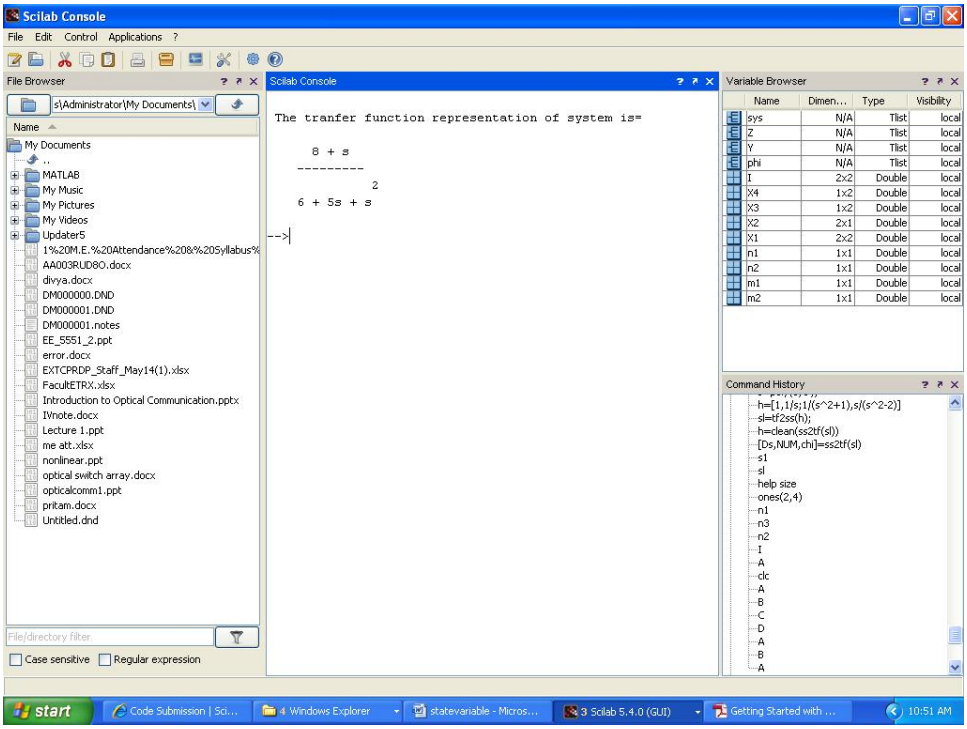


Figure 6.1: statemodel

```
16 Z=Y*X2
17 //sys=tf2ss(Z)
18 disp(Z,"The tranfer function representation of
       system is=")
19 //disp(sys)
```