Scilab Manual for
Control Systems & Electrical Machines
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Contents

List of Experiments

List of Figures

Experiment: 1

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

Scilab code Solution 1.01 polezeroplot

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

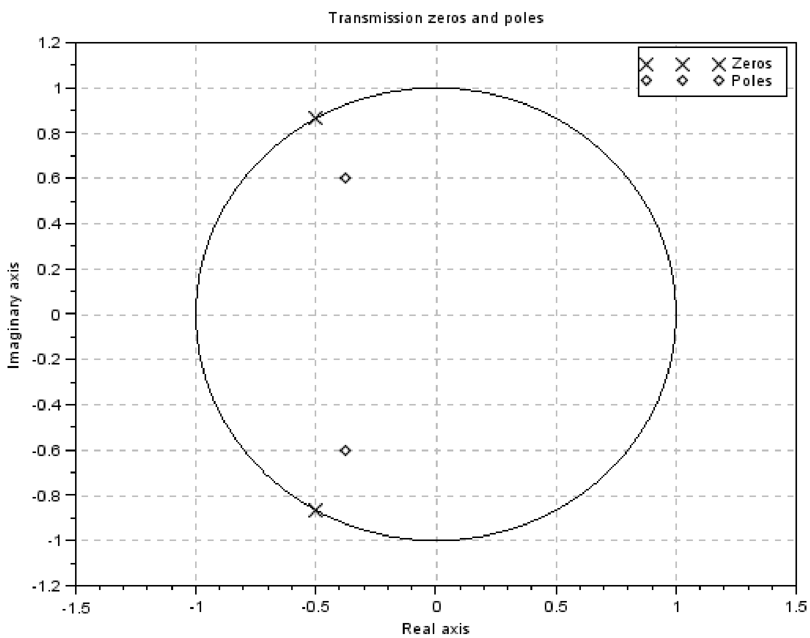

Figure 1.1: polezeroplot

Experiment: 2

To study transient response for given system

Scilab code Solution 2.02 transientresponse

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

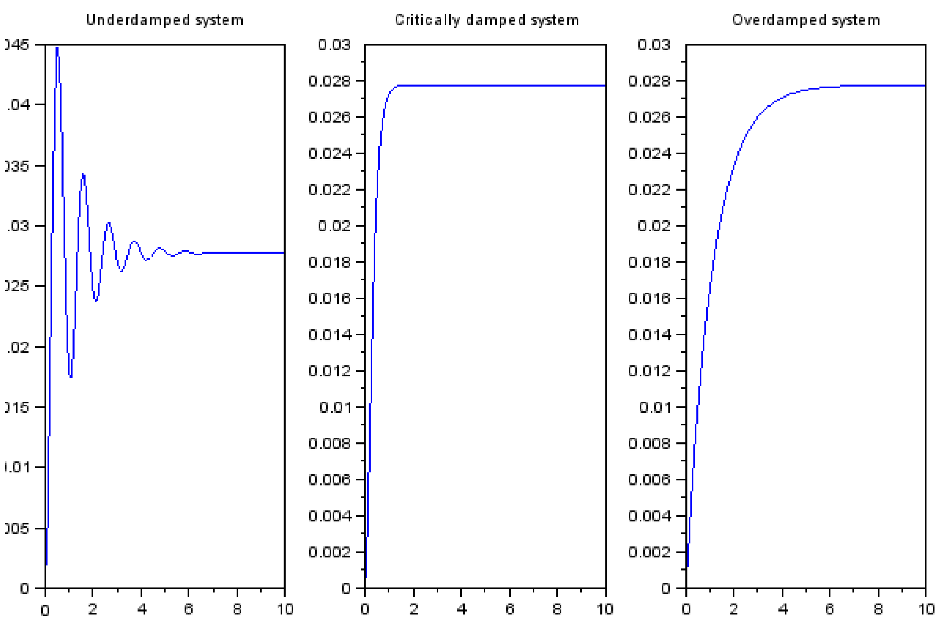

Figure 2.1: transientresponse

Experiment: 3

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

Scilab code Solution 3.03 stabilityanalysis

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

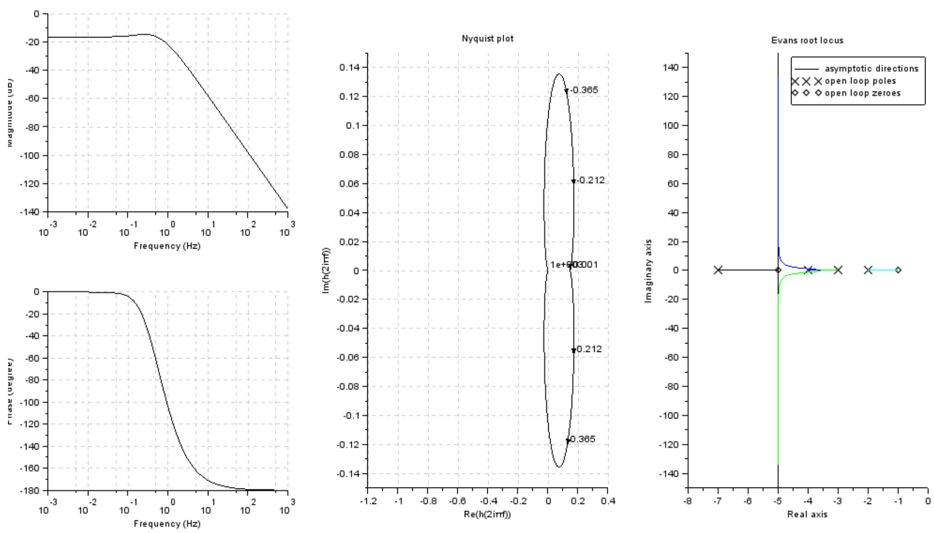

Figure 3.1: stabilityanalysis

Experiment: 4

To compare open loop and closed loop system.

Scilab code Solution 4.04 systemcomparison

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

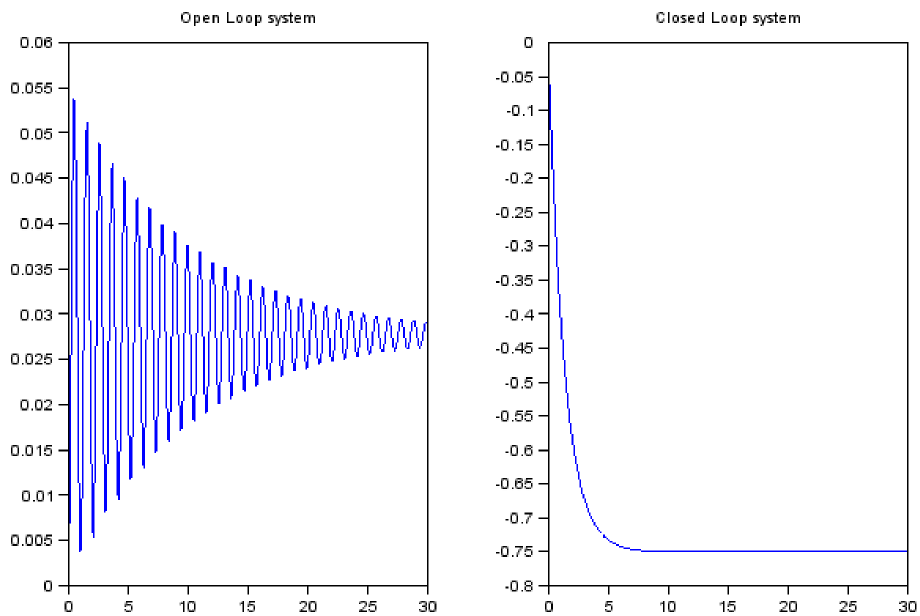

Figure 4.1: systemcomparison

```
num2=1;den2 =3;
TF2 = syslin('c',num2,den2)
S1=TF1/.TF2
disp(S1)
subplot(122)
t=0:0.1:30;
y1 = csim('step', t, S1);
title('Closed Loop system');
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

```
//          5 To use block reduction technique to get
    the equivalent system
// 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
//OS=Windows XP sp3
//Scilab version 5.4.0
//sample values
clc
s=poly(0,'s');
n1=[2*s];//input numerator and denomenator of
   transfer function
d1=[3+s^2];
h1=syslin('c',n1/d1); //transient response
n2=[2];
d2=[s+4];
```

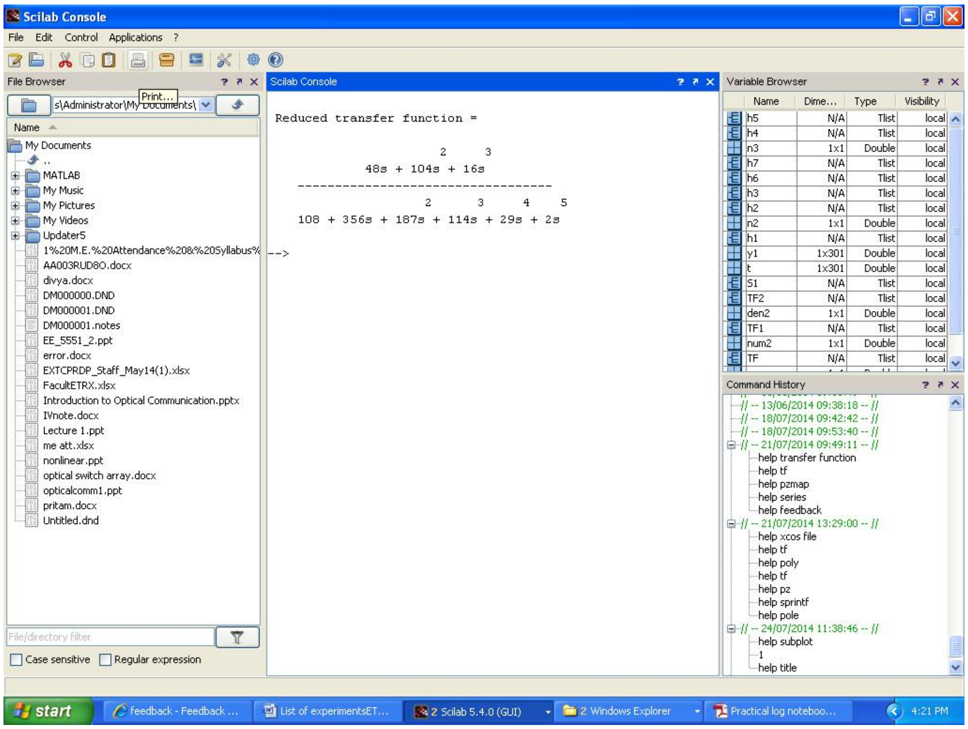

Figure 5.1: blockreduction

```
h2=syslin('c',n2/d2);
n3=[4];
d3=[s+6];
h3=syslin('c',n3/d3);
n4=[s];
d4=[1+2*s];
h4=syslin('c',n4/d4);
h5=h3/.h4
h6=h1*h5
h7=h6/.h3
disp(h7, "Reduced transfer function =")
```

Experiment: 6

To implement state model reduction technique for the given system

Scilab code Solution 6.06 statemodel

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

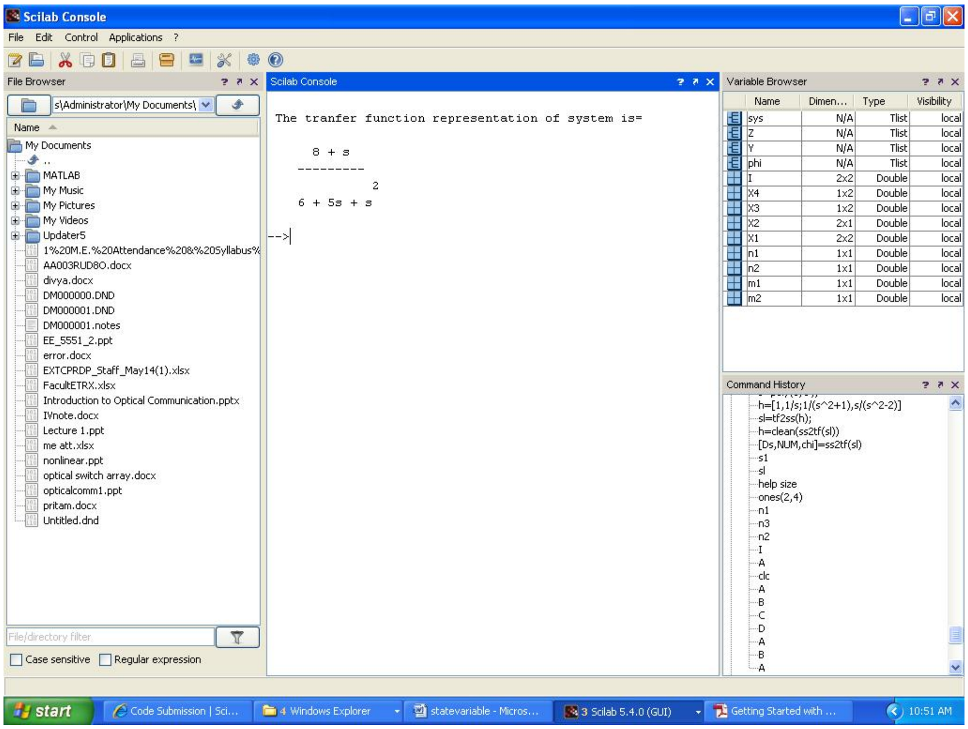

Figure 6.1: statemodel

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