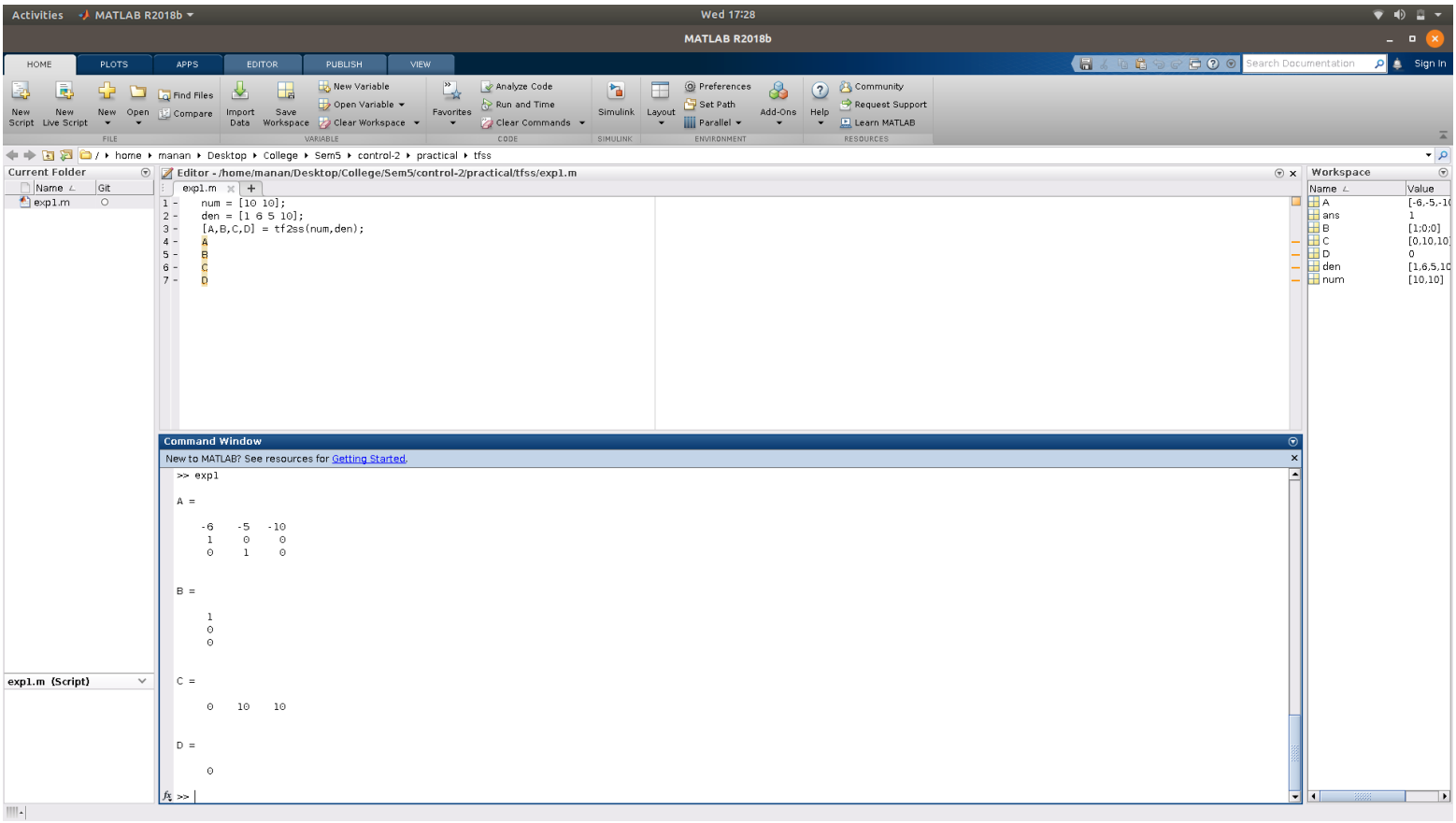
LAB PRACTICAL FILE:
Name: Manan Madan
Roll No: 2018UIC3087
ICE - Section 2

List of Experiments

1. **State Space and Transfer Function**
2. **Pole Placement**
3. **Cruise Control**
4. **DC Motor**
5. **Frequency Design**

STATE SPACE AND TRANSFER FUNCTION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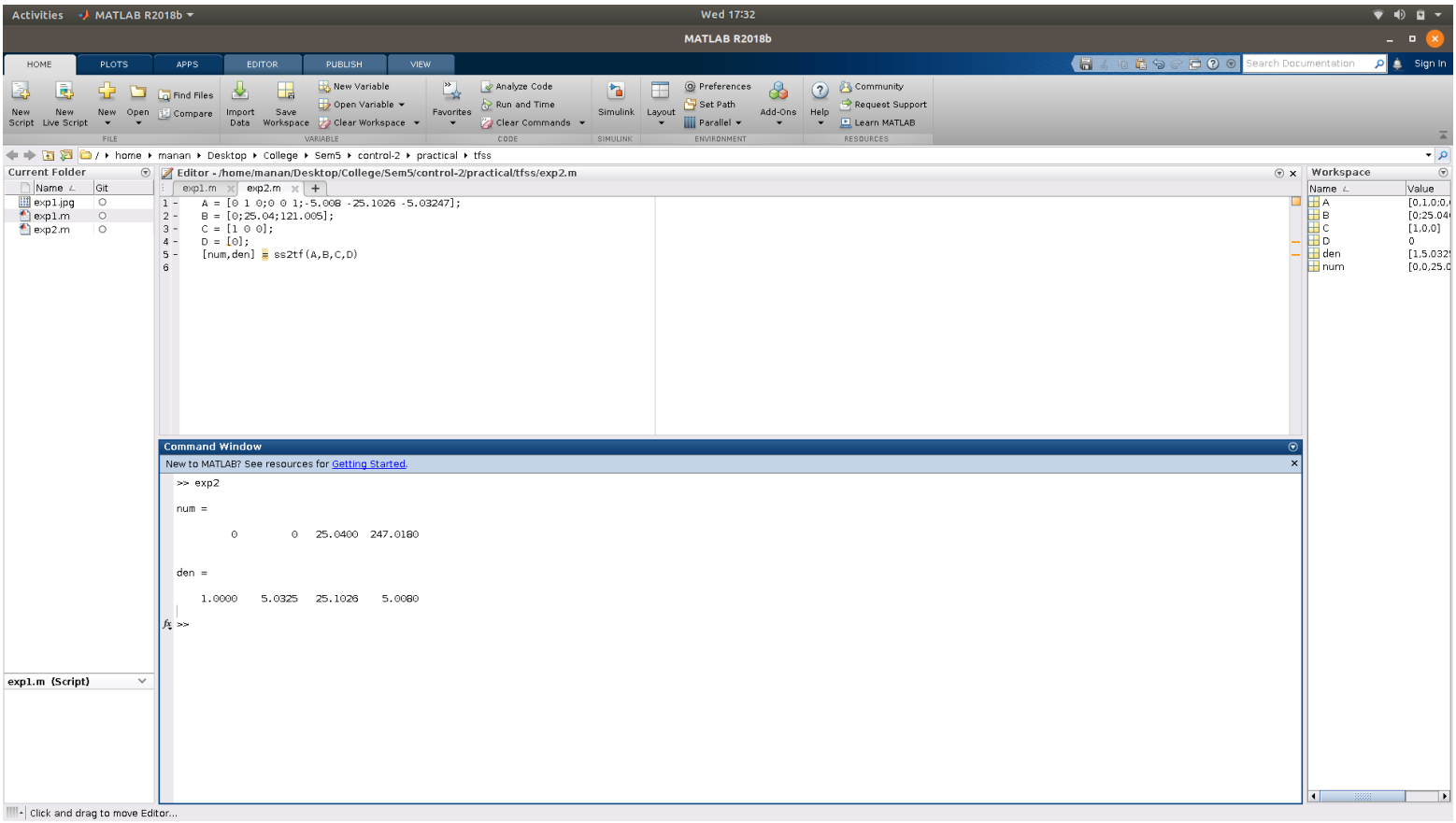
/ home manan Desktop College Sem5 control-2 practical tfss
Current Folder
Name
Git
exp1.m
exp1.m (Script)
Editor - /home/manan/Desktop/College/Sem5/control-2/practical/tfss/exp1.m
exp1.m
1 - num = [10 10];
2 - den = [1 6 5 10];
3 - [A,B,C,D] = tf2ss(num,den);
4 - A
5 - B
6 - C
7 - D
Command Window
New to MATLAB? See resources for Getting Started.
>> exp1
A =
-6 -5 -10
1 0 0
0 1 0
B =
1
0
0
C =
0 10 10
D =
0
>>
Workspace
Name
Value
A [-6,-5,-10
ans 1
B [1;0;0]
C [0,10,10]
D 0
den [1,6,5,10
num [10,10]


Activities
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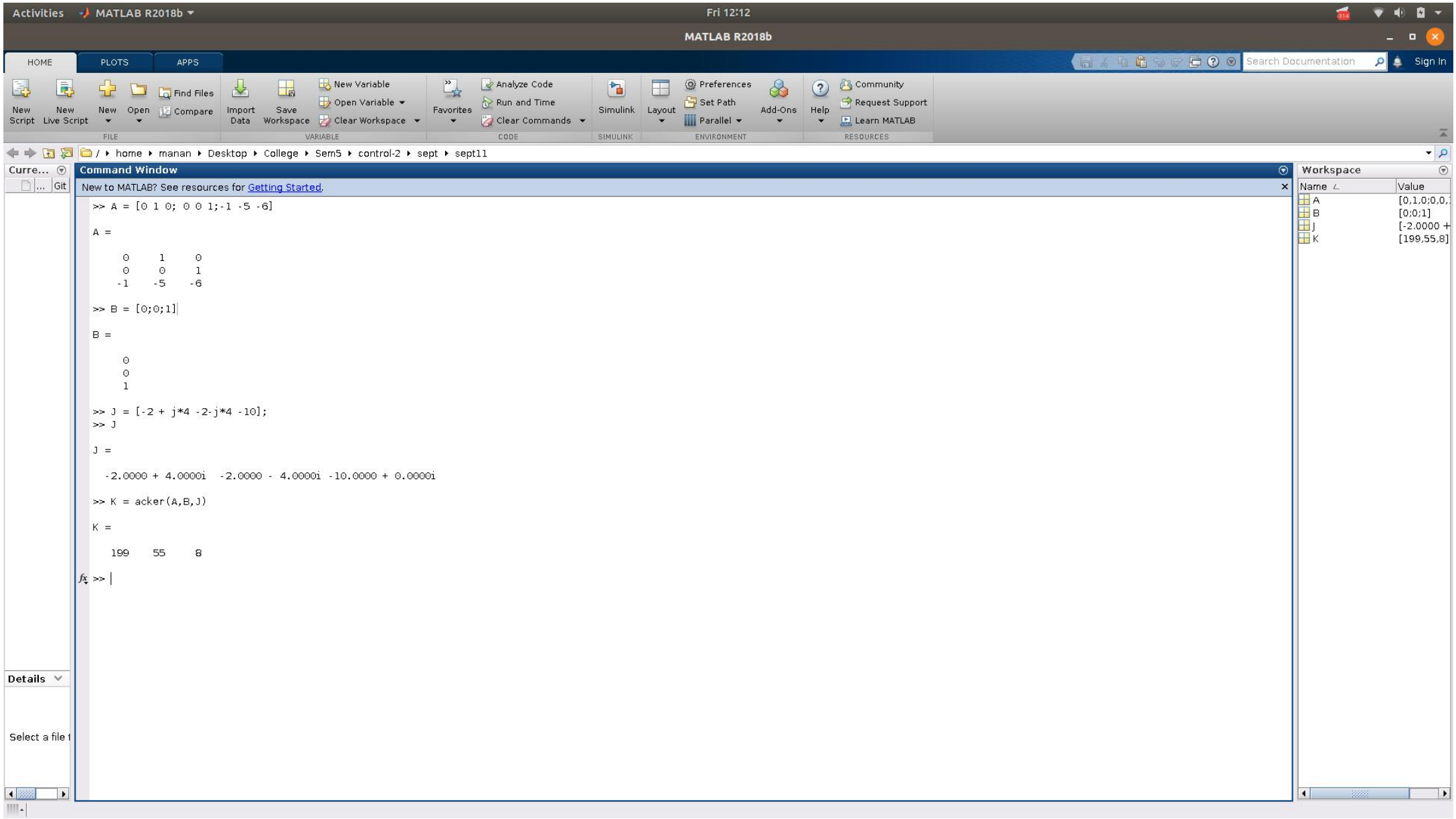
Current Folder
Name
Git
exp1.jpg
exp1.m
exp2.m
exp1.m (Script)
Editor - /home/manan/Desktop/College/Sem5/control-2/practical/tfss/exp2.m
exp1.m
exp2.m
1 - A = [0 1 0;0 0 1;-5.008 -25.1026 -5.03247];
2 - B = [0;25.04;121.005];
3 - C = [1 0 0];
4 - D = [0];
5 - [num,den] = ss2tf(A,B,C,D)
6
Workspace
Name
Value
A [0,1,0;0,
B [0;25.04
C [1,0,0]
D 0
den [1,5.032
num [0,0,25.0
Command Window
New to MATLAB? See resources for Getting Started.
>> exp2
num =
0 0 25.0400 247.0180
den =
1.0000 5.0325 25.1026 5.0080
>>
Click and drag to move Editor...

POLE PLACEMENT


Activities
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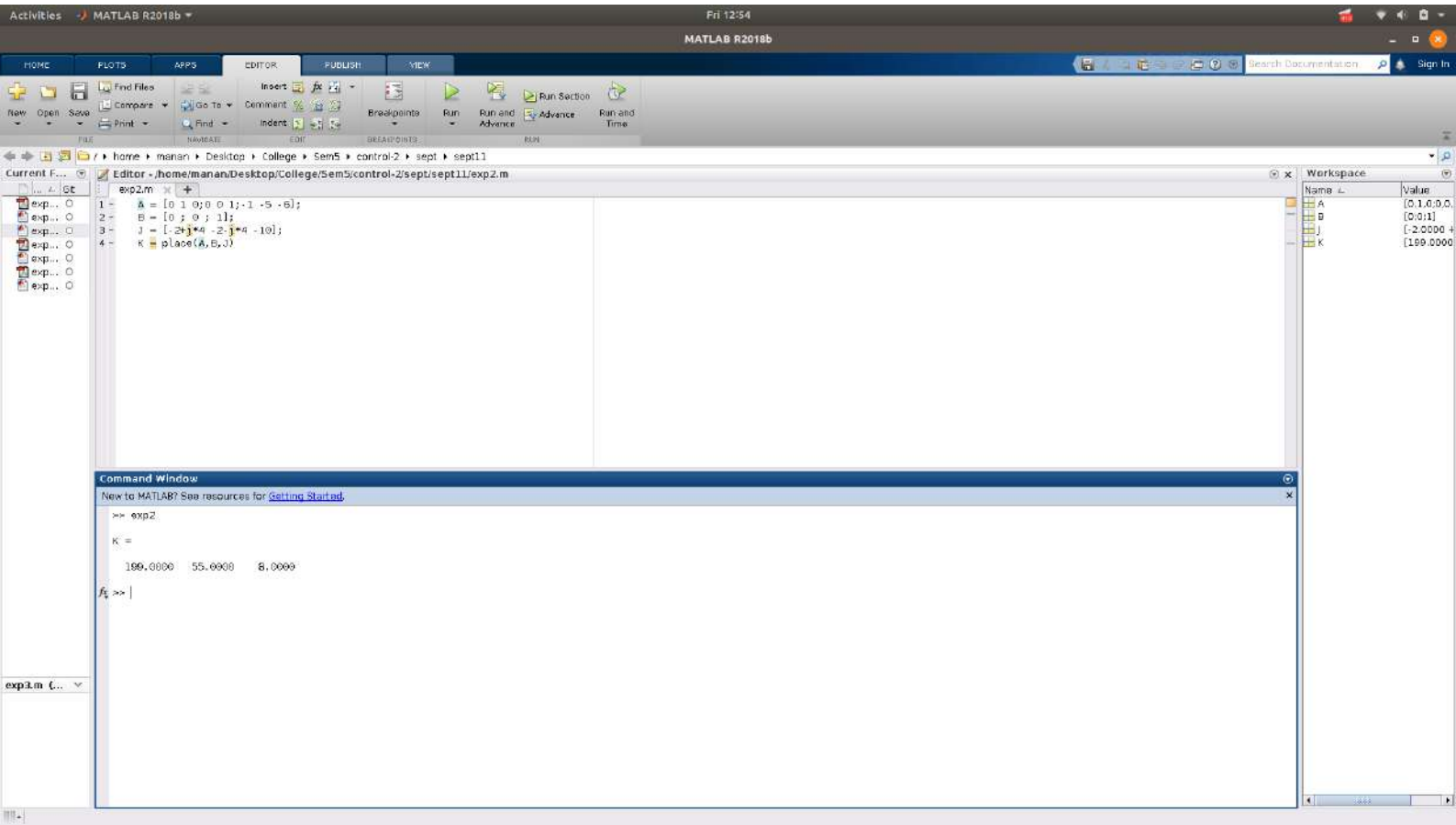
Details
Select a file t
Command Window
New to MATLAB? See resources for Getting Started.
>> A = [0 1 0; 0 0 1;-1 -5 -6]
A =
0 1 0
0 0 1
-1 -5 -6
>> B = [0;0;1]
B =
0
0
1
>> J = [-2 + j*4 -2-j*4 -10];
>> J
J =
-2.0000 + 4.0000i -2.0000 - 4.0000i -10.0000 + 0.0000i
>> K = acker(A,B,J)
K =
199 55 8
>>
Workspace
Name
Value
A
[0,1,0;0,0,
B
[0;0;1]
J
[-2.0000 +
K
[199,55,8]


Activities
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Current F...
Editor - /home/manan/Desktop/College/Sem5/control-2/sept/sept11/exp2.m
exp2.m
1 - A = [0 1 0;0 0 1;-1 -5 -6];
2 - B = [0 ; 0 ; 1];
3 - J = [-2+j*4 -2-j*4 -10];
4 - K = place(A,B,J)
Workspace
Name
Value
A
[0,1,0;0,0,
B
[0;0;1]
J
[-2.0000 +
K
[199.0000
Command Window
New to MATLAB? See resources for Getting Started.
>> exp2
K =
199.0000 55.0000 8.0000
fx >>

Activities MATLAB R2018b Fri 12:42

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FILE NAVIGATE EDIT BREAKPOINTS

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Current F...

exp...
exp...

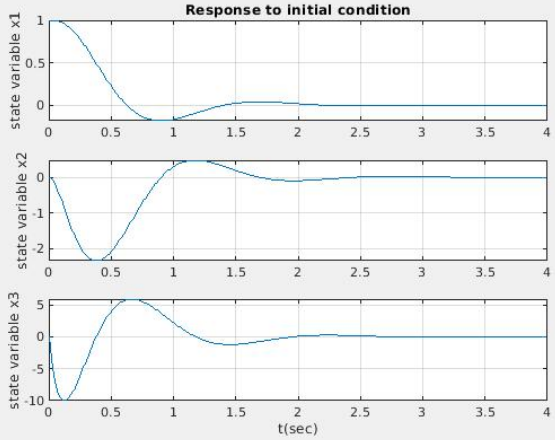
Editor - /home/manan/Desktop/College/Sem5/control-2/sept/sept11/exp3.m

exp3.m

```
1 -    A = [0 1 0;0 0 1;-1 -5 -6];
2 -    B = [0;0;1];
3 -    K = [199 55 8];
4 -    sys = ss(A-B*K,eye(3),eye(3),eye(3));
5 -    t = 0:0.01:4;
6 -    x = initial(sys,[1;0;0],t);
7 -    x1 = [1 0 0]*x';
8 -    x2 = [0 1 0]*x';
9 -    x3 = [0 0 1]*x';
10 -   subplot(3,1,1);plot(t,x1),grid
11 -   title('Response to initial condition')
12 -   ylabel('state variable x1')
13 -   subplot(3,1,2);plot(t,x2),grid
14 -   ylabel('state variable x2')
15 -   subplot(3,1,3);plot(t,x3),grid
16 -   xlabel('t(sec)')
17 -   ylabel('state variable x3')
```

Figure 1

File Edit View Insert Tools Desktop Window Help



Command Window

New to MATLAB? See resources for Getting Started.

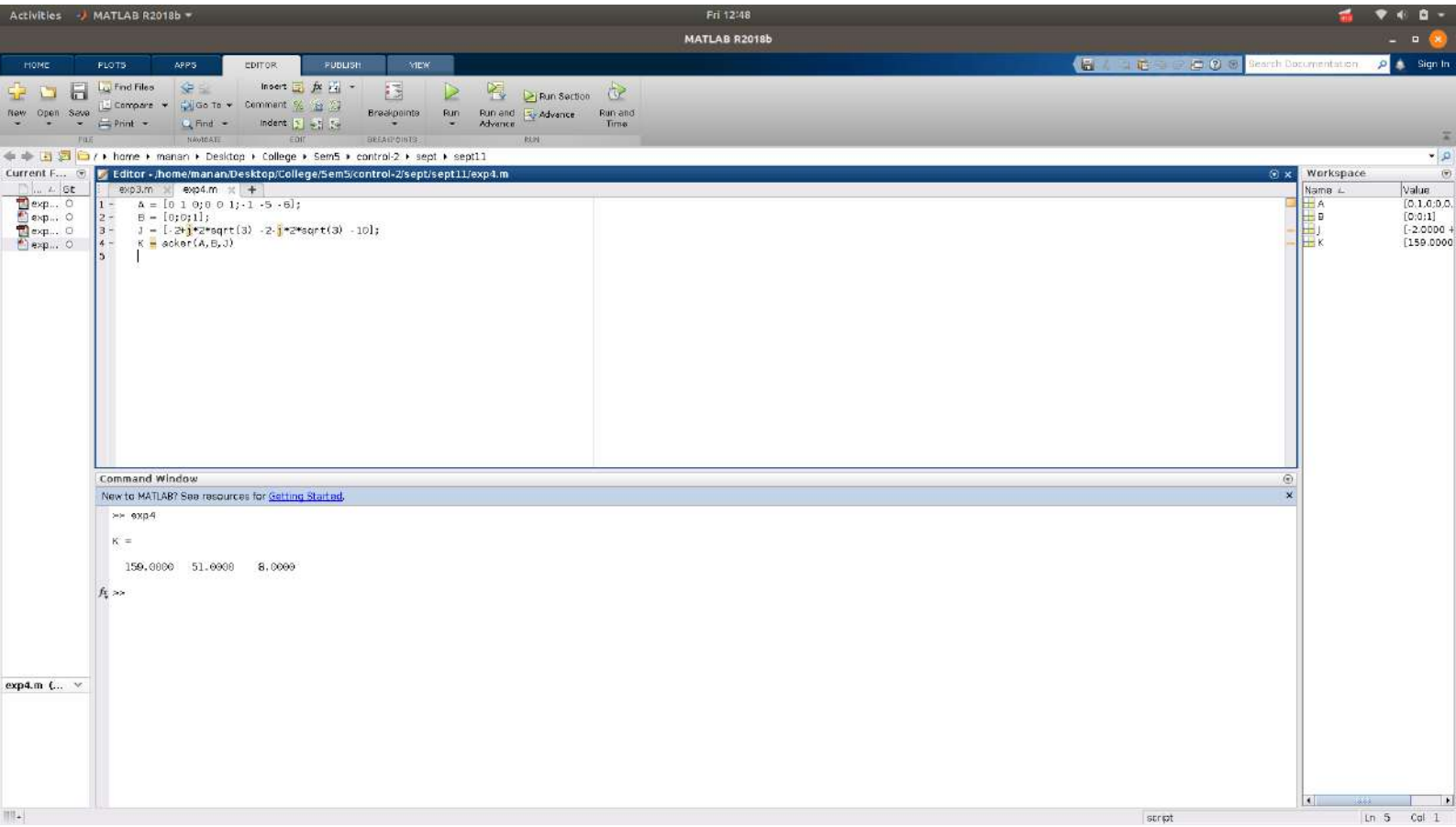
```
>> exp3
>>
```

Workspace

Name	Value
A	[0,1,0;0,0,
B	[0;0;1]
K	[199,55,8]
sys	3x3 ss
t	1x401 dou
x	401x3 dou
x1	1x401 dou
x2	1x401 dou
x3	1x401 dou

Details

Select a file to vie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Current F...
Editor - /home/manan/Desktop/College/Sem5/control-2/sept/sept11/exp4.m
exp3.m
exp4.m
1 - A = [0 1 0;0 0 1;-1 -5 -6];
2 - B = [0;0;1];
3 - J = [-2+j*2*sqrt(3) -2-j*2*sqrt(3) -10];
4 - K = acker(A,B,J)
5
Workspace
Name
Value
A
[0,1,0;0,0,
B
[0;0;1]
J
[-2.0000 +
K
[159.0000
Command Window
New to MATLAB? See resources for Getting Started.
>> exp4
K =
159.0000 51.0000 8.0000
fx >>
exp4.m (...
script
Ln 5 Col 1

CRUISE CONTROL

```
'Name : Manan'
'Roll No ; 2018UIC3087'
m = 1000;
b = 50;
u = 500;
A = [0 1;0 -b/m];
B = [0;1/m];
C = [0 1];
D = [0];
step(A,B*u,C,D)
[num,den] = ss2tf(A, B, C, D);
kp = 800;
ki = 40;
num1 = [kp,ki];
den1 = [1 0];
num2 = conv(num,num1)
den2 = conv(den,den1)
[numc,denc] = cloop(num2,den2,-1);
t = 0:0.1:20;
step(10*numc,denc,t)
axis([0 20 0 10])
```

```
>> ccmodel

ans =

    'Name : Manan'


ans =

    'Roll No ; 2018UIC3087'


num2 =

         0    0.8000    0.0400         0


den2 =

    1.0000    0.0500         0         0

>>
```

Name	Value
A	[0,1;0,-0.05
ans	'Roll No ; 20
b	50
B	[0;1.0000e-
C	[0,1]
D	0
den	[1,0.0500,0]
den1	[1,0]
den2	[1,0.0500,0,
denc	[1,0.8500,0.
ki	40
kp	800
m	1000
num	[0,1.0000e-
num1	[800,40]
num2	[0,0.8000,0.
numc	[0,0.8000,0.
t	*1x201 doub*
u	500

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MATLAB R2018b

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cnst...
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ssm...

ccmodel1...

Editor - /home/manan/Desktop/College/Sem5/control-2/practical/cruise_control/ccmodel1.m

ccmodel1.m

```
1 -  m=1000;
2 -  b=50;
3 -  u=500;
4 -  A=[0 1;0 -b/m];
5 -  B=[0;1/m];
6 -  C=[0 1];
7 -  D=0;
8
9 -  step(A,B,C,D);
10
11 - [num,den]=ss2tf(A,B,C,D);
12 - k=600;
13 - [numc,denc]=cloop(k*num,den,-1);
14 - t=0:0.1:20;
15 - step(10*numc,denc,t)
16 - axis([0 20 0 10])
17
18
19
20
```

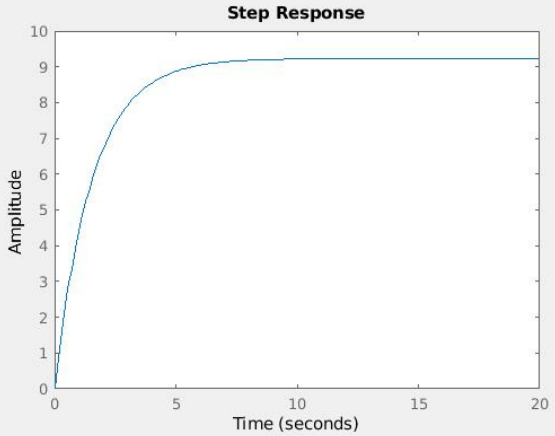
Command Window

New to MATLAB? See resources for Getting Started.

```
>> ccmodel1
fx >>
```

Figure 1

File Edit View Insert Tools Desktop Window Help

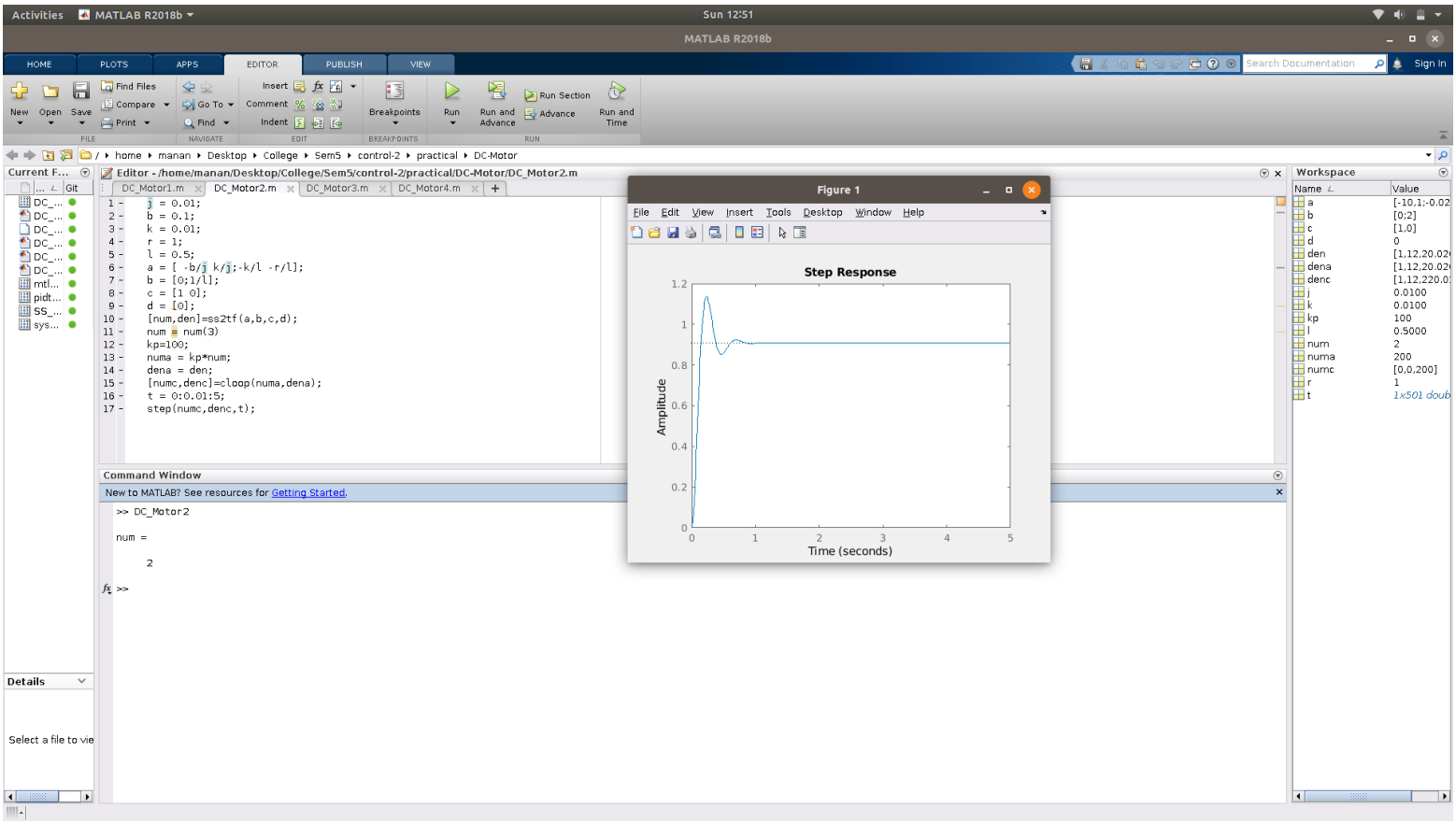


Workspace

Name	Value
A	[0,1;0,-0.05
b	50
B	[0;1.0000e-
C	[0,1]
D	0
den	[1,0.0500,0]
denc	[1,0.6500,0]
k	600
m	1000
num	[0,1.0000e-
numc	[0,0.6000,0]
t	1x201 doub
u	500

Ln 1 Col 1

DC MOTOR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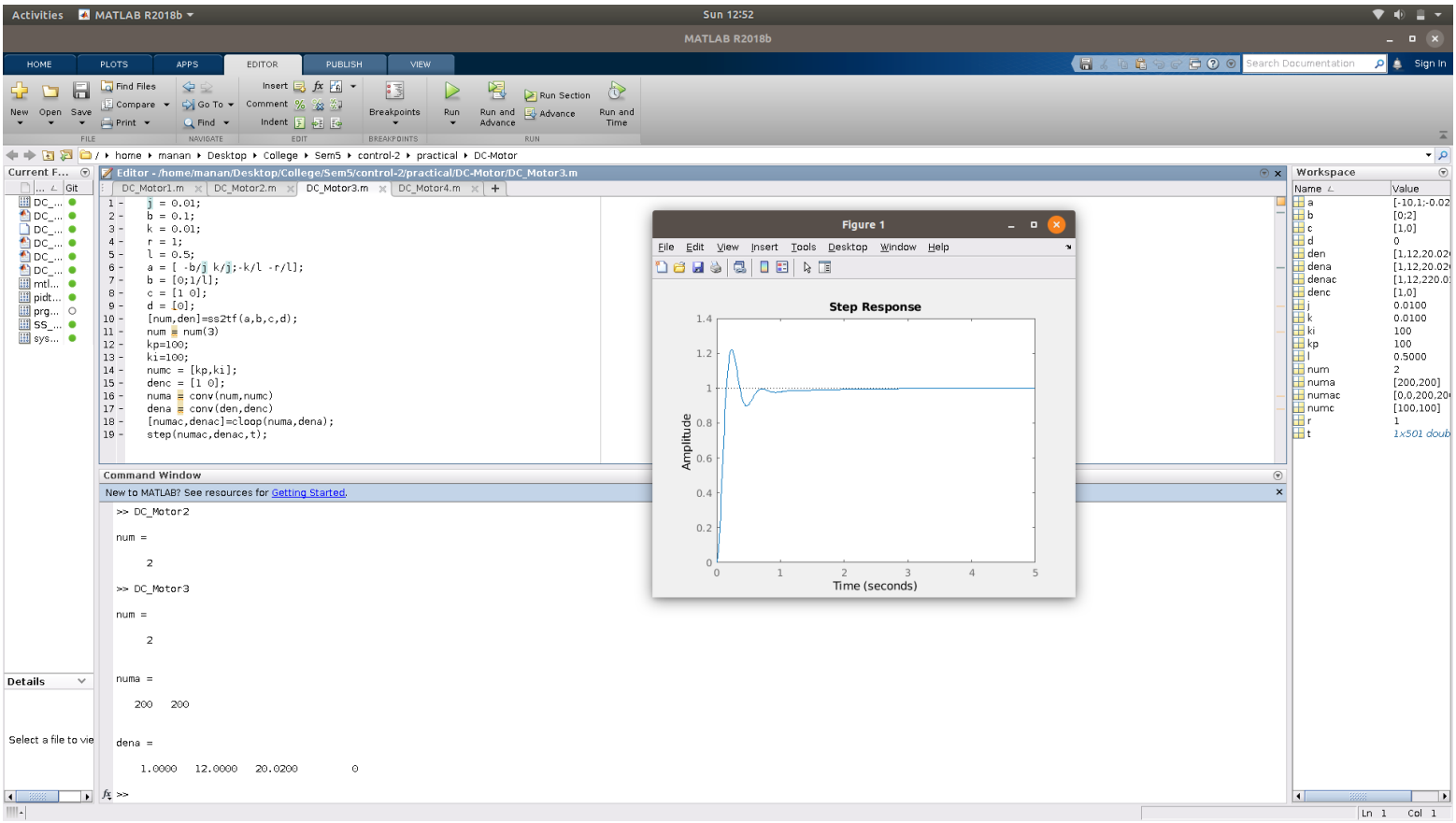
/ home manan Desktop College Sem5 control-2 practical DC-Motor
Current F...
Editor - /home/manan/Desktop/College/Sem5/control-2/practical/DC-Motor/DC_Motor2.m
DC_Motor1.m
DC_Motor2.m
DC_Motor3.m
DC_Motor4.m
1 - j = 0.01;
2 - b = 0.1;
3 - k = 0.01;
4 - r = 1;
5 - l = 0.5;
6 - a = [-b/j k/j;-k/l -r/l];
7 - b = [0;1/l];
8 - c = [1 0];
9 - d = [0];
10 - [num,den]=ss2tf(a,b,c,d);
11 - num = num(3)
12 - kp=100;
13 - numa = kp*num;
14 - dena = den;
15 - [numc,denc]=cloop(numa,dena);
16 - t = 0:0.01:5;
17 - step(numc,denc,t);
Figure 1
File Edit View Insert Tools Desktop Window Help
Step Response
Amplitude
Time (seconds)
0
0.2
0.4
0.6
0.8
1
1.2
0
1
2
3
4
5
Workspace
Name
Value
a [-10,1;-0.02
b [0;2]
c [1,0]
d 0
den [1,12,20.02
dena [1,12,20.02
denc [1,12,220.0
j 0.0100
k 0.0100
kp 100
l 0.5000
num 2
numa 200
numc [0,0,200]
r 1
t 1x501 doub
Command Window
New to MATLAB? See resources for Getting Started.
>> DC_Motor2
num =
2
>>
Details
Select a file to vie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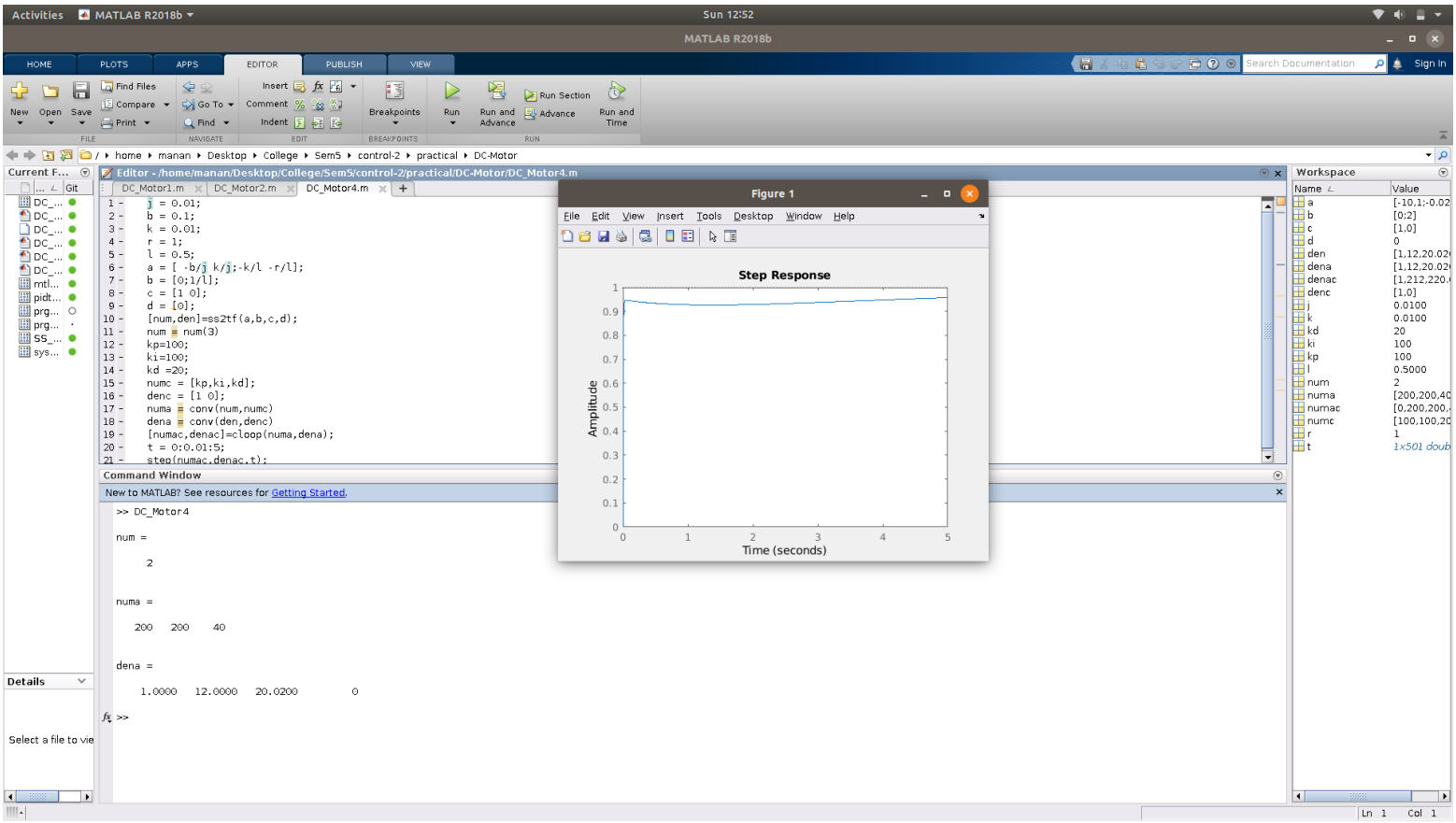
DC_Motor1.m
DC_Motor2.m
DC_Motor3.m
DC_Motor4.m
1 - j = 0.01;
2 - b = 0.1;
3 - k = 0.01;
4 - r = 1;
5 - l = 0.5;
6 - a = [-b/j k/j;-k/l -r/l];
7 - b = [0;1/l];
8 - c = [1 0];
9 - d = [0];
10 - [num,den]=ss2tf(a,b,c,d);
11 - num = num(3)
12 - kp=100;
13 - ki=100;
14 - numc = [kp,ki];
15 - denc = [1 0];
16 - numa = conv(num,numc)
17 - dena = conv(den,denc)
18 - [numac,denac]=cloop(numa,dena);
19 - step(numac,denac,t);
Figure 1
File Edit View Insert Tools Desktop Window Help
Step Response
Amplitude
Time (seconds)
Workspace
Name
Value
Command Window
New to MATLAB? See resources for Getting Started.
>> DC_Motor2
num =
2
>> DC_Motor3
num =
2
numa =
200 200
dena =
1.0000 12.0000 20.0200 0
>>
Details
Select a file to vie
Ln 1 Col 1


Activities
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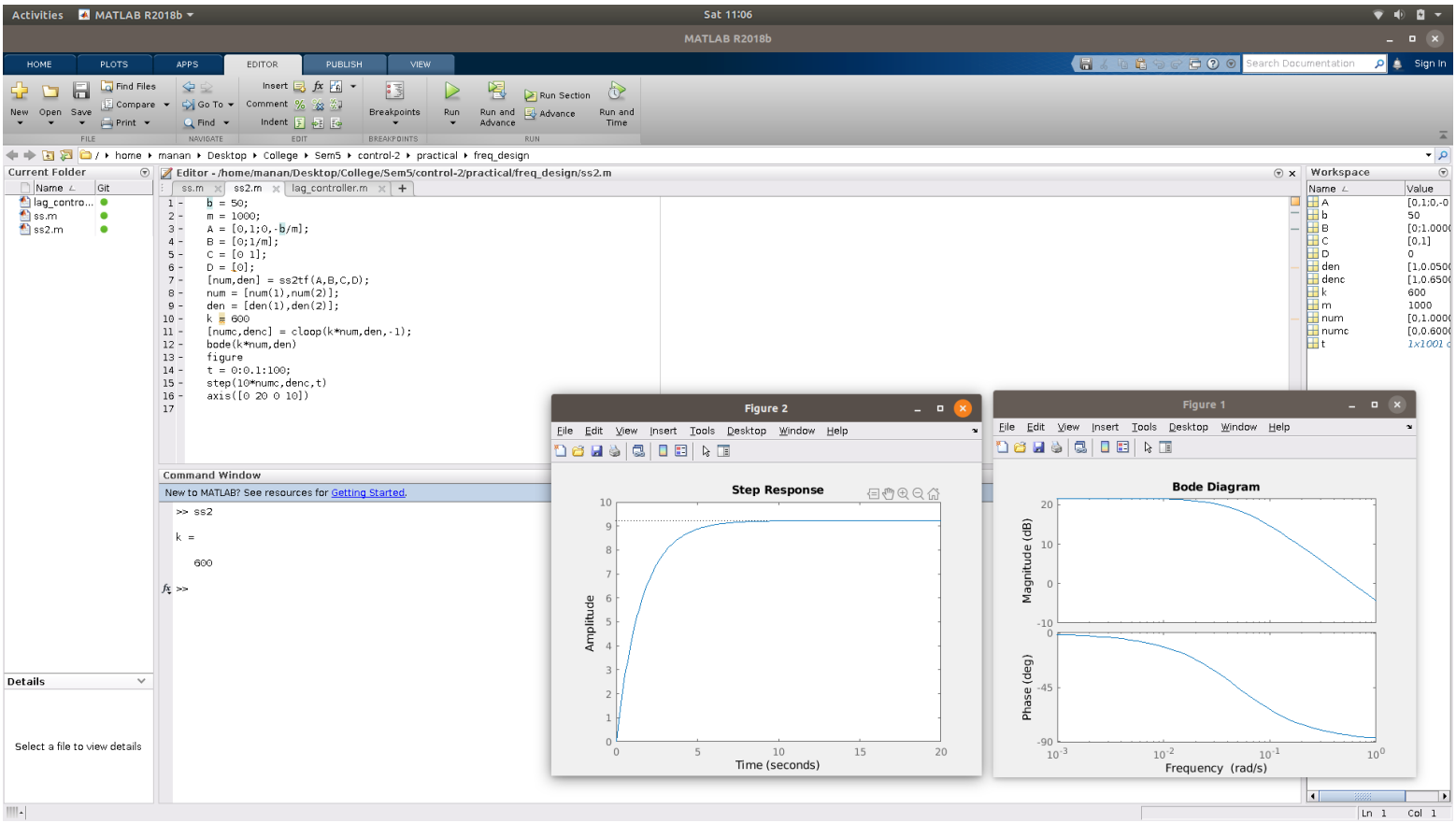
Current F...
Editor - /home/manan/Desktop/College/Sem5/control-2/practical/DC-Motor/DC_Motor4.m
DC_Motor1.m
DC_Motor2.m
DC_Motor4.m
1 - j = 0.01;
2 - b = 0.1;
3 - k = 0.01;
4 - r = 1;
5 - l = 0.5;
6 - a = [-b/j k/j;-k/l -r/l];
7 - b = [0;1/l];
8 - c = [1 0];
9 - d = [0];
10 - [num,den]=ss2tf(a,b,c,d);
11 - num = num(3)
12 - kp=100;
13 - ki=100;
14 - kd =20;
15 - numc = [kp,ki,kd];
16 - denc = [1 0];
17 - numa = conv(num,numc)
18 - dena = conv(den,denc)
19 - [numac,denac]=cloop(numa,dena);
20 - t = 0:0.01:5;
21 - step(numac,denac,t);
Figure 1
File Edit View Insert Tools Desktop Window Help
Step Response
Amplitude
Time (seconds)
Command Window
New to MATLAB? See resources for Getting Started.
>> DC_Motor4
num =
2
numa =
200 200 40
dena =
1.0000 12.0000 20.0200 0
>>
Workspace
Name
Value
a [-10,1;-0.02
b [0;2]
c [1,0]
d 0
den [1,12,20.02
dena [1,12,20.02
denac [1,212,220.
denc [1,0]
j 0.0100
k 0.0100
kd 20
ki 100
kp 100
l 0.5000
num 2
numa [200,200,40
numac [0,200,200,
numc [100,100,20
r 1
t 1x501 doub
Details
Select a file to vie
Ln 1
Col 1

FREQUENCY DESIGN


Activities
MATLAB R2018b
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ss.m
ss2.m
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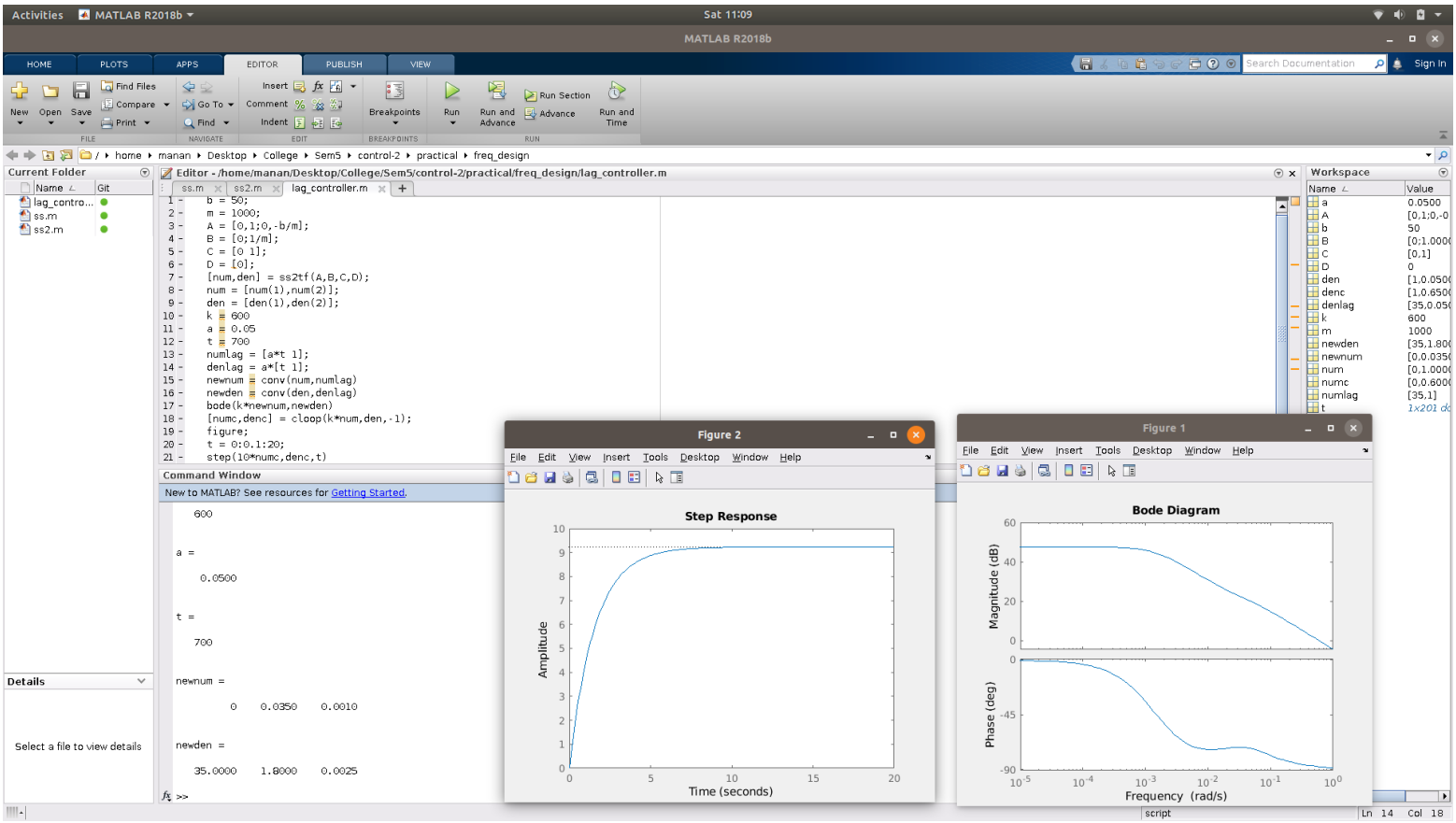
ss.m
ss2.m
lag_controller.m
b = 50;
m = 1000;
A = [0,1;0,-b/m];
B = [0;1/m];
C = [0 1];
D = [0];
[num,den] = ss2tf(A,B,C,D);
num = [num(1),num(2)];
den = [den(1),den(2)];
k = 600
[numc,denc] = cloop(k*num,den,-1);
bode(k*num,den)
figure
t = 0:0.1:100;
step(10*numc,denc,t)
axis([0 20 0 10])
Workspace
Name
Value
A [0,1;0,-0
b 50
B [0;1.000
C [0,1]
D 0
den [1,0.050
denc [1,0.650
k 600
m 1000
num [0,1.000
numc [0,0.600
t 1x1001
Command Window
New to MATLAB? See resources for Getting Started.
>> ss2
k =
600
>>
Details
Select a file to view details
Figure 2
File Edit View Insert Tools Desktop Window Help
Step Response
Amplitude
Time (seconds)
Figure 1
File Edit View Insert Tools Desktop Window Help
Bode Diagram
Magnitude (dB)
Phase (deg)
Frequency (rad/s)
Ln 1
Col 1


Activities
MATLAB R2018b
Sat 11:09
MATLAB R2018b
HOME
PLOTS
APPS
EDITOR
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New
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Indent
Breakpoints
Run
Run and Advance
Run Section
Advance
Run and Time
FILE
NAVIGATE
EDIT
BREAKPOINTS
RUN
/ home manan Desktop College Sem5 control-2 practical freq_design
Current Folder
Name
Git
lag_contro...
ss.m
ss2.m
Editor - /home/manan/Desktop/College/Sem5/control-2/practical/freq_design/lag_controller.m
ss.m
ss2.m
lag_controller.m
1 - b = 50;
2 - m = 1000;
3 - A = [0,1;0,-b/m];
4 - B = [0;1/m];
5 - C = [0 1];
6 - D = [0];
7 - [num,den] = ss2tf(A,B,C,D);
8 - num = [num(1),num(2)];
9 - den = [den(1),den(2)];
10 - k = 600
11 - a = 0.05
12 - t = 700
13 - numlag = [a*t 1];
14 - denlag = a*[t 1];
15 - newnum = conv(num,numlag)
16 - newden = conv(den,denlag)
17 - bode(k*newnum,newden)
18 - [numc,denc] = cloop(k*num,den,-1);
19 - figure;
20 - t = 0:0.1:20;
21 - step(10*numc,denc,t)
Workspace
Name
Value
a 0.0500
A [0,1;0,-0
b 50
B [0;1.000
C [0,1]
D 0
den [1,0.050
denc [1,0.650
denlag [35,0.05
k 600
m 1000
newden [35,1.80
newnum [0,0.035
num [0,1.000
numc [0,0.600
numlag [35,1]
t 1x201 do
Command Window
New to MATLAB? See resources for Getting Started.
600
a =
0.0500
t =
700
newnum =
0 0.0350 0.0010
newden =
35.0000 1.8000 0.0025
>>
Details
Select a file to view details
Figure 2
File Edit View Insert Tools Desktop Window Help
Step Response
Amplitude
Time (seconds)
Figure 1
File Edit View Insert Tools Desktop Window Help
Bode Diagram
Magnitude (dB)
Phase (deg)
Frequency (rad/s)
script
Ln 14 Col 18