# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM



**CONTROL SYSTEM LABORATORY II**

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SUBJECT:- CONTROL SYSTEM LAB- (II)

SUBJECT CODE:-EE16203

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**EXPERIMENT -2**

**AIM:-** Determination of Stability , Controllability and Observability of LTI system.

**MATLAB CODE:-**

clc;

clear all;

fprintf('for Poles & Zeroes click: 1 \nfor transfer function click: 2\n');

Choice=input(' ');

if Choice==1

zeroes=input('Enter zeros: ');

poles=input('Enter poles: ');

gain=input('Enter gain: ');

T=zpk(zeroes,poles,gain)

num=poly(zeroes);

den= poly(poles);

[A,B,C,D]=tf2ss(num,den)

S=ss(A,B,C,D);

elseif Choice==2

num=input('Enter the numerator: ')

den=input('Enter the denominator: ')

if (length(den)-1)==2

P=[0 1;1 0];

elseif (length(den)-1)==3

P=[0 0 1; 0 1 0;1 0 0];

end

[A,B,C,D]=tf2ss(num,den)

A=inv(P)\*A\*P;

B=inv(P)\*B;

C=C\*P;

S=ss(A,B,C,D);

end

%Stability

Eigen=eig(A)

if Eigen==-1

disp('System is Stable');

else

disp('System is unstable')

end

%Controllabilty

C=ctrb(A,B);

RANK\_1=rank(C);

if (length(A)==RANK\_1)

disp('System is Controllable');

else

disp('System is Not Controllable');

end

%Observability

O=obsv(A,C);

RANK\_2=rank(O);

if (length(A)==RANK\_2)

disp('System is Observable')

else

disp('System is Not Observable');

end

step(S)

hold on;

impulse(S)

**OUTPUT:- 1**

for Poles & Zeroes click: 1

for transfer function click: 2

1

Enter zeros: [-2.5 ]

Enter poles: [-2.5 1]

Enter gain: 1

T =

(s+2.5)

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(s+2.5) (s-1)

Continuous-time zero/pole/gain model.

A =

-1.5000 2.5000

1.0000 0

B =

1

0

C =

1.0000 2.5000

D =

0

Eigen =

-2.5000

1.0000

System is unstable

System is Controllable

System is Observable



**OUTPUT:- 2**

for Poles & Zeroes click: 1

for transfer function click: 2

2

Enter the numerator: [1 3]

num =

1 3

Enter the denominator: [1 3 2]

den =

1 3 2

A =

-3 -2

1 0

B =

1

0

C =

1 3

D =

0

Eigen =

-1

-2

System is unstable

System is Controllable

System is Observable

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**DISCUSSION:-**

* State space was obtained using both transfer function and using poles and zeroes.
* Stability, Controllability and observability was determined for both the system.
* From the result it was observed, the three properties are independent of each other.
* Stability is an internal property of the system while Controllability and Observability is an external property of the system.
* By comparison with the transfer function we can say that transfer function only deals with the input and output of the system so we can say that transfer function is incomplete model .
* State space model deals with input and output of the system as well as incorporate with the internal part of the system. Hence we can say that state space model is complete model.