

Department of Electrical Engineering
Subject
Control System (REE-503) Odd Sem: 2018-19

1. TO DETERMINE THE TIME RESPONSE OF A SECOND ORDER SYSTEM FOR STEP I/P AND OBTAIN PERFORMANCE PARAMETERS

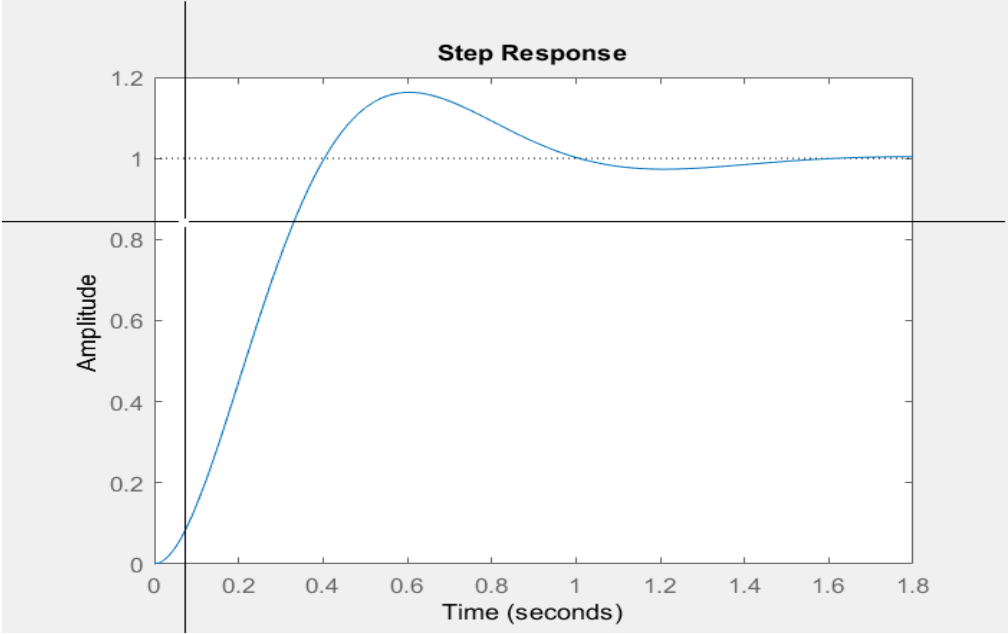
THEORY: The performance of a control system is expressed in terms of transient response of a unit step input because it is easy to generate. The transient response of a control system to a unit step input depends upon initial conditions; consider a second order system with unit step input and system initially at rest that is all initial conditions are zero. The following are the common transient response characteristics.

1. **Delay time (t_d):** The delay time is the time required for the response to reach 50% of the final value in first time.
2. **Rise time (t_r):** It is the time required for the response to rise from 10% to 90% of its final value for over damped system and 0 –100% for under damped systems.
3. **Peak time (t_p):** It is the time required for the response to reach the first peak of the time response or first peak overshoot.

PROGRAM:

```
% obtain the unit step response of second order system with zeta=0.5 &
% wn=6 rad/sec
clf
clc
clear all
zeta=0.5;
wn=6;
n=(wn*wn);
d=[1 2*zeta*wn wn*wn];
G=tf(n,d);
step(G)
gtext('wn^2/(s^2+2*zeta*wn+wn^2)')
```

Result :



2. TO PLOT ROOT LOCUS DIAGRAM OF AN OPEN LOOP TRANSFER FUNCTION AND DETERMINE RANGE OF GAIN K FOR STABILITY

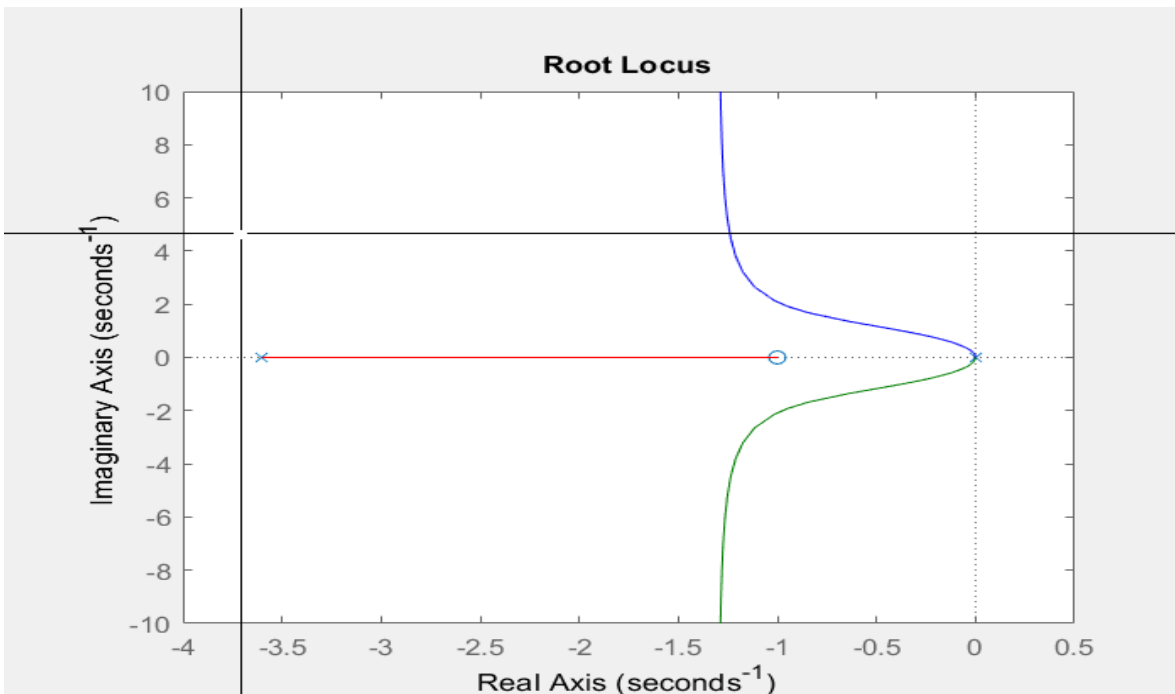
OBJECTIVE: To Plot root locus diagram of an open loop transfer function and determine range of gain 'K' for stability.

THEORY: Root Locus is a Graphical Method in which roots of the characteristics equation are plotted in s – plane for different values of parameter. The locus of the roots of the characteristics equation when gain is varied from zero to infinity is called Root locus.

PROGRAM:

```
% sketch the root locus for system
clf
clc
clear all
n=[1 1];
d=conv([1 0 0],[0 1 3.6]);
grid;
G=tf(n,d);
rlocus(G)
gtext('G(s)=K(s+1)/(s^2(s+3.6))')
```

Result:



3. TO PLOT BODE DIAGRAM OF AN OPEN LOOP TRANSFER FUNCTION

OBJECTIVE: To plot a Bode diagram of an open loop transfer function.

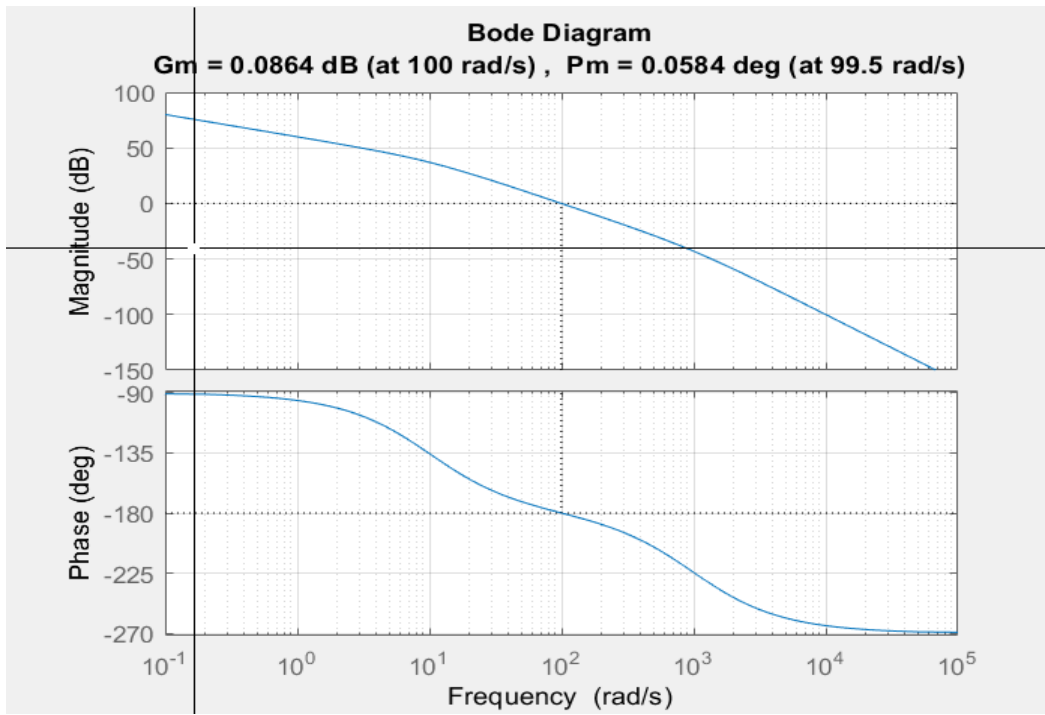
THEORY: Bode Plot is a Graphical representation of the transfer function for determining the stability of the control system. Bode diagram Consists of two plots. One plot of Logarithm of the magnitude of a sinusoidal transfer function, other is a plot of phase angle, both plots are plotted against the frequency. The curves are drawn on semilog paper, using the log scale for frequency and linear scale for magnitude (in Decibels) or Phase angle (in degrees). The Magnitude is represented in decibels. Thus, Bode plot consists of

- 1) $20 \log |G(j\omega)|$ Vs $\log \omega$.
- 2) Phase Shift Vs $\log \omega$.

PROGRAM:

```
% sketch Bode plot for transfer function
% G(S)=1000/s(1+0.1s)(1+0.001s)
clf
clc
clear all
n=1000;
d=conv([1 0],conv([0.1 1],[0.001 1]));
G=tf(n,d);
[Gm,Pm,Wg,Wp]=margin(G);
margin(G)
%bode(G)
grid on
gtext('G(S)=1000/s(1+0.1s)(1+0.001s)')
```

Result:



4. TO DRAW A NYQUIST PLOT OF AN OPEN LOOP TRANSFER FUNCTION AND EXAMINE THE STABILITY OF THE CLOSED LOOP SYSTEM

OBJECTIVE: To Draw a Nyquist plot of an open loop transfer functions and examines the stability of the closed loop system.

THEORY: Nyquist Stability Criterion states that a closed loop system is stable if the contour GH of the open loop transfer function $G(s)H(s)$ Corresponding to the Nyquist Contour in S-Plane encircles the Point $(-1 + j0)$ in Counterclockwise Direction and the Number of Counterclockwise Encirclement about $(-1 + j0)$ equals the number of Poles of $G(s)H(s)$ in the Right half of S- plane.

The Closed Loop System is Stable if the Contour GH of $G(s)H(s)$ Dose not pass through or dose not encircles $(-1 + j0)$ Point.

PROGRAM:

```
% Sketch the nyquist plot for system
% G(s)H(s)=60/(s+1)(s+2)(s+5)
clf
clc
clear all
n=60;
d=conv([1 1],conv([1 2],[1 5]));
GH=tf(n,d);
nyquist(GH)
grid on
gtext('G(s)H(s)=60/(s+1)(s+2)(s+5)')
```

Result:

