Edward Venator

EECS 304 Spring 2012

Lab 5

1











2  
BWOL Measured +/- 3dB

1. Phase margin = 81.7°  
   Gain margin = ∞dB

|  |  |  |  |
| --- | --- | --- | --- |
|  | Step | Ramp | Parabola |
| Ess | 0 | 25/6 | ∞ |

BWOL = .17 rad/s  
Rolloff = 45 dB/dec  
ωn = none

1. Phase margin = 92.5°  
   Gain margin = ∞dB

|  |  |  |  |
| --- | --- | --- | --- |
|  | Step | Ramp | Parabola |
| Ess | 0 | 4/5 | ∞ |

BWOL = .6 rad/s   
Rolloff = 20 dB/dec  
ωn =none

1. Phase margin = -28.7°  
   Gain margin = 12dB

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Step | Ramp | Parabola | Cubic |
| Ess | 0 | 0 | 0 | 4 |

BWOL = .21 rad/s   
Rolloff = 40 dB/dec  
ωn =none

1. Phase margin = 9.37°  
   Gain margin = -∞dB

|  |  |  |  |
| --- | --- | --- | --- |
|  | Step | Ramp | Parabola |
| Ess | 0 | 0 | 68/425 |

BWOL = .14 rad/s   
Rolloff = 40dB/dec  
ωn =none

1. Phase margin = 90.2°  
   Gain margin = 61.9dB

|  |  |  |  |
| --- | --- | --- | --- |
|  | Step | Ramp | Parabola |
| Ess | 0 | 40 | ∞ |

BWOL = 9 x 10-4 rad/s   
Rolloff =50 dB/dec  
ωn =none

3

 

This system is stable for gain k=4, but unstable for k=7.

Bode Diagrams

k = 7 k = 4



|  |  |  |
| --- | --- | --- |
| K | Gm | Pm |
| 7 | -2.92 dB | 10 deg |
| 4 | 1.94 dB | -6.21 deg |

The gain margin for k=7 is -2.92 dB (unstable) and 1.94 dB for k=4 (stable). This matches the results from the Nyquist plots.



The root locus plot shows that the system will be stable for gains less than about 5.02, which is consistent with the Nyquist and Bode results.

%Edward Venator

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%Lab 5

%1a

L\_a\_num = [1 8 12];

L\_a\_den = [1 16 65 50 0];

L\_a = tf(L\_a\_num, L\_a\_den);

figure(1)

bode(L\_a);

margin(L\_a)

grid();

%title('Bode Diagram of System 1A');

%1b

L\_b\_num = [1 2 8];

L\_b\_den = [1 2 10 0];

L\_b = tf(L\_b\_num, L\_b\_den);

figure(2)

bode(L\_b);

margin(L\_b)

grid();

%title('Bode Diagram of System 1B');

%1c

L\_c\_num = [1 2 1];

L\_c\_den = [1 4 0 0 0];

L\_c = tf(L\_c\_num, L\_c\_den);

figure(3)

bode(L\_c);

margin(L\_c)

grid();

%title('Bode Diagram of System 1C');

%1d

L\_d\_num = [1 6 76 136];

L\_d\_den = [1 14 125 850 0 0];

L\_d = tf(L\_d\_num, L\_d\_den);

figure(4)

bode(L\_d);

margin(L\_d)

grid();

%title('Bode Diagram of System 1D');

%1e

L\_e\_num = [1 2 1];

L\_e\_den = [1 38 322 -720 800 0];

L\_e = tf(L\_e\_num, L\_e\_den);

figure(5)

bode(L\_e);

margin(L\_e)

grid();

%title('Bode Diagram of System 1E');

%3

k = 7;

num = [1 20 100];

den = [1 0 0 0];

sys = tf(k\*num, den);

figure(6);

nyquist(sys);

title('Nyquist Diagram (K=7)')

figure(7);

margin(sys);

k = 4;

sys = tf(k\*num, den);

figure(8);

nyquist(sys);

title('Nyquist Diagram (K=4)')

figure(9);

margin(sys);

sys = tf(num, den);

figure(10);

rlocus(sys);