Edward Venator

EECS 304 Spring 2012

Lab 4

1



2 ESS Constraint:

kc=5; T = 10

Controller Transfer Function:

Closed Loop Transfer Function:

3



Mp=0.7\_%; TS= 1.76 sec

4



ESS = |99 - 100| / 100 = 1%

%Edward Venator

%EECS 304 Spring 2012

%Lab 4

%Clear screen and variables

clc;

clear all;

%Plant transfer function

p\_num = 1;

p\_den = conv(conv([1 0],[1 5]),[1 10]);

p = tf(p\_num, p\_den)

%1 Plot the RL without the controller

Mp = .07;

Ts = 3;

Kv = 10;

damping = sqrt(log(Mp)^2 / (pi^2 + log(Mp)^2))

omega\_n = 4 / (damping \* Ts)

%Plot parameters

figure(1)

rlocus(p)

title('Root Locus of the Plant Without Controller');

hold on;

omega\_vec = -.1:-.1:-10;

plot(omega\_vec,omega\_vec\*(1-damping^2));

plot(omega\_vec,-omega\_vec\*(1-damping^2));

plot(-omega\_n\*damping\*ones(1,11),(-5:1:5));

hold off;

%rltool(p);

%2 Design the controller

k\_c = 5;

alpha = 10;

T = .01;

c\_num = k\_c \* alpha \* [T 1];

c\_den = [alpha \* T 1];

c = tf(c\_num, c\_den)

sys = series(c,p);

figure(2)

rlocus(sys)

title('Root Locus of the Plant With Controller');

hold on;

omega\_vec = -.1:-.1:-10;

plot(omega\_vec,omega\_vec\*(1-damping^2),'r');

plot(omega\_vec,-omega\_vec\*(1-damping^2),'r');

plot(-omega\_n\*damping\*ones(1,11),(-5:1:5),'r');

hold off;

%3 Step Response

sys\_fb = feedback(sys,1)

figure(3);

step\_resp = step(sys\_fb);

title('Step Response');

Mp = max(step\_resp)-1

%Ramp Response

t\_vec = 0:.1:100;

y\_vec = lsim(sys\_fb,t\_vec,t\_vec);

figure(4);

plot(t\_vec, t\_vec, t\_vec, y\_vec);

title('Ramp Response');

kV = (y\_vec(1001)-100)/100