Edward Venator

EECS 304 Spring 2012

Lab 3

1. Open Loop:  
   Closed Loop:
2.   
   Conclusion: R only affects the stability of one pair of poles.
3. Conclusion: increasing R will make the system more stable, and R must be above .5208 for system stabiltiy.

|  |  |  |
| --- | --- | --- |
| **R** | **Damping** | **Frequency** |
| .53 | .00133 | 7.3 rad/s |
| 1 | .053 | 6.63 rad/s |

Conclusion: increasing R makes the system less oscillatory by increasing damping, but slows down the system response (natural frequency).

1. 



These plots confirm my conclusions from 4.

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%Clear screen and variables

clc;

clear all;

%System constants

Tg = 0.1;

Tt = 1;

M = 0.0625;

D = 0.1;

T = 2.0;

%Define Turbine TF

turbine\_num = [1/(Tg \* Tt)];

turbine\_den = [1, (1/Tg+1/Tt), 1/(Tg \* Tt)];

turbine\_sys = tf(turbine\_num, turbine\_den);

%Define Power Oscillation TF

power\_osc\_den = [M D T];

power\_osc\_sys = tf([1], power\_osc\_den);

%Full Physical System TF

full\_sys = series(turbine\_sys, power\_osc\_sys);

%Full System in TF

tach = tf([1 0], [1]);

disp('Open Loop Transfer Function');

full\_sys\_w\_tach = series(full\_sys, tach)

%Root Locus

figure(1)

rlocus(full\_sys\_w\_tach);

title('Root Locus of the System (parameter is 1/R)');

%RLTool

%rltool(full\_sys\_w\_tach);

%Test for R=.53

feedback\_tf= tf(1, .53);

sys1 = feedback(full\_sys\_w\_tach, feedback\_tf);

%Plot Step Response

figure(2)

step(sys1)

title('Step Response for R=0.53');

%Test for R=1

feedback\_tf= tf(1, 1);

sys2 = feedback(full\_sys\_w\_tach, feedback\_tf);

%Plot Step Response

figure(3)

step(sys2)

title('Step Response for R=1.0');