EE5351: CONTROL SYSTEM DESIGN

LABORATORY 03

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Summative Laboratory Form

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| --- | --- |
| Semester | 05 |
| Module Code | EE5351 |
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| Lab Number | 03 |
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# OBSERVATIONS

Question1)

1. = ++ 1

= 2

= 3

= 4

Considering the above equations t/f Given as:

=

By negliting the rotor inductance (Due to the Small value)

=

=

1. A screenshot of a computer screen

   AI-generated content may be incorrect.

Figure 1: Simulink for the Question 3

1. To get the closed loop transfer function

=

=

1. A screenshot of a computer

   AI-generated content may be incorrect.

Figure 2: Simulink for updated version from Q3

A screenshot of a computer

AI-generated content may be incorrect.

Figure 3: Time domain response for Q5

Question2)

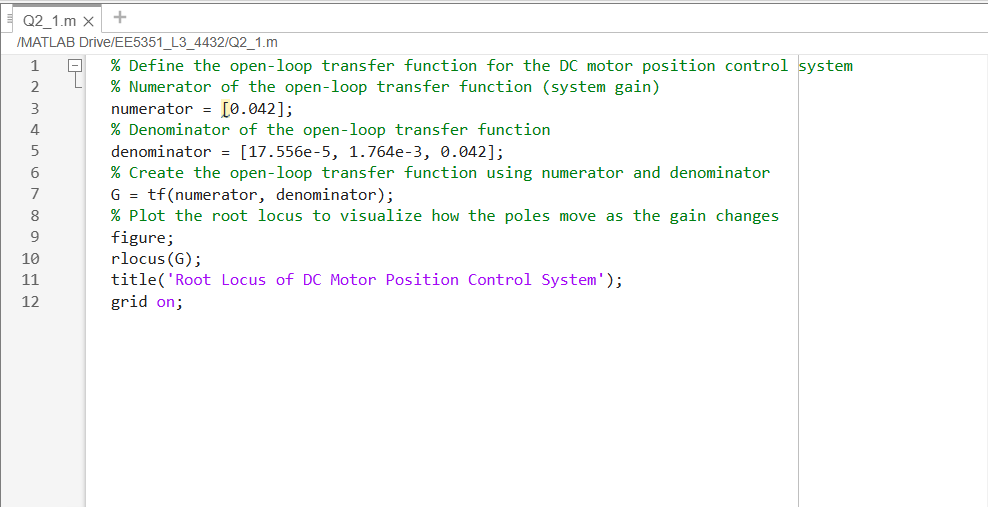
1. 

Figure 4: Code for Root locus of closed loop

1. A graph of a graph

   AI-generated content may be incorrect.

Figure 5: Root Locus

1. By considering the characteristic equation

2 =

= 10.045

clc; clear; close all;

%% Define the Open-Loop Transfer Function for DC Motor Position Control

numerator = [0.042]; % System gain

denominator = [17.556e-5, 1.764e-3, 0.042]; % Denominator coefficients

G = tf(numerator, denominator);

%% Plot the Root Locus of the Open-Loop System

figure;

rlocus(G);

title('Root Locus of DC Motor Position Control System');

grid on;

%% Increase Natural Frequency by 10%

omega\_n = 10.045; % Current natural frequency (example value)

omega\_n\_new = 1.1 \* omega\_n; % New desired natural frequency (increase by 10%)

% Now, we will modify the system to achieve the new natural frequency.

% We need to adjust the parameters of the system such that the new ωn is achieved.

% Adjust the denominator to increase ωn by 10%

denominator\_new = denominator;

denominator\_new(1) = denominator\_new(1) \* (omega\_n\_new / omega\_n); % Adjust the first denominator term to scale with ωn

% Create the new transfer function

G\_new = tf(numerator, denominator\_new);

%% Plot the Root Locus of the Modified System

figure;

rlocus(G\_new);

title('Root Locus After Increasing Natural Frequency by 10%');

grid on;

A graph of a graph

AI-generated content may be incorrect.

Figure 6: Root Locus after increasing Omega

clc; clear; close all;

%% Define the Open-Loop Transfer Function for DC Motor Position Control

numerator = [0.042]; % System gain

denominator = [17.556e-5, 1.764e-3, 0.042]; % Denominator coefficients

G = tf(numerator, denominator);

%% Plot the Root Locus of the Open-Loop System

figure;

rlocus(G);

title('Root Locus of DC Motor Position Control System');

grid on;

%% Increase Natural Frequency by 10%

omega\_n = 10.045; % Current natural frequency (example value)

omega\_n\_new = 1.1 \* omega\_n; % New desired natural frequency (increase by 10%)

% Now, we will modify the system to achieve the new natural frequency.

% We need to adjust the parameters of the system such that the new ωn is achieved.

% Adjust the denominator to increase ωn by 10%

denominator\_new = denominator;

denominator\_new(1) = denominator\_new(1) \* (omega\_n\_new / omega\_n); % Adjust the first denominator term to scale with ωn

% Create the new transfer function

G\_new = tf(numerator, denominator\_new);

%% Plot the Root Locus of the Modified System

figure;

rlocus(G\_new);

title('Root Locus After Increasing Natural Frequency by 10%');

grid on;

% Calculate and plot the time response of both systems

figure;

step(G, 'b', G\_new, 'r'); % Original in blue, Modified in red

title('Comparison of Time Responses: Original vs Modified System');

legend('Original System', 'Modified System');

grid on;

A graph with red and blue lines

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Figure 7: Comparison of the time responses

Question3)

A computer screen shot of a computer screen

Description automatically generated1.

Figure 8:Designing Comapesator

2.



Figure : Time domain response [**θm(t)]** of the closed loop position control system of DC motor

# References

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| --- | --- |
| [1] | “Tutorials Point,” [Online]. Available: https://www.tutorialspoint.com/control\_systems/control\_systems\_construction\_  root\_locus.htm. |
| [2] | “Mathwworks,” [Online]. Available: https://in.mathworks.com/help/control/ref/dynamicsystem.rlocus.html. |
| [3] | [Online]. Available: https://www.geeksforgeeks.org/control-systems-controllers/. |