EE5351: CONTROL SYSTEM DESIGN

LABORATORY 01

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GROUP NO: CE07

DATE : 24/01 /2025

Table : Summative Laboratory Form

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| --- | --- |
| Semester | 05 |
| Module Code | EE5351 |
| Module Name | Control System Design |
| Lab Number | 01 |
| Lab Name | Laboratory Section 1 |
| Lab conduction date | 2024.11.05 |
| Report Submission date | 2025.01.24 |

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# OBSERVATION

Table : Observations

|  |  |  |
| --- | --- | --- |
| Terminal Resistance (Rm) | 8.4 | Ω |
| Rotor inductance (Lm) | 1.16 | mH |
| Equivalent(Jen) | 2.09×10⁻⁵ | kgm² |
| Torque constant (Kt) | 0.042 | Nm/A |
| Voltage constant (Km) | 0.042 | Nm/A |

# CALCULATION

Q1.

1. .
2. Voltage equation:

2. Back EMF equation:

3. Torque equation:

4. Motor torque relationship:

1. From equations (1), (2), (3), and (4), the speed control transfer function is derived as:

From equations (1), (2), (3), and (4):

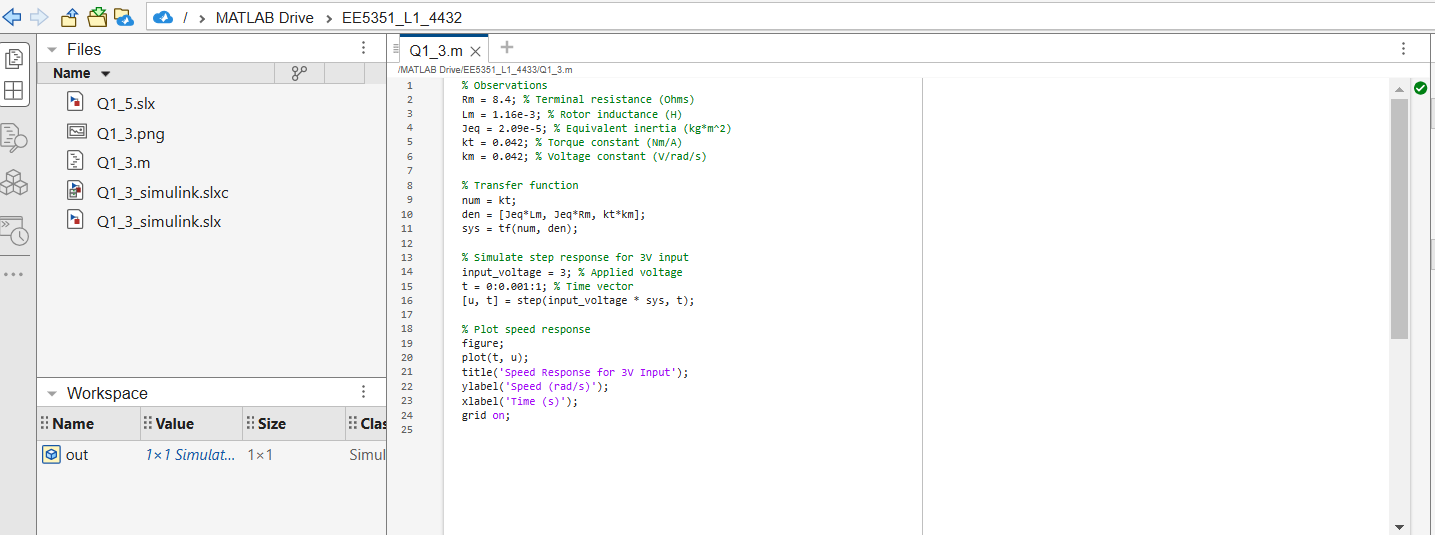
1. 

Figure : MathLab code for the Speed Response

A graph of a speed response

Description automatically generated

Figure : Speed Response Get by Mathlab

A black grid with yellow lines

Description automatically generated

Figure : Speed Response Given by Simulink



Simplified Equations for Speed Control Transfer Function

Simplified Equations for Position Control Transfer Function



A screenshot of a computer

AI-generated content may be incorrect.

Figure : Simulink for simplified transfer function



From the equations 1, 2, 3, 4;

=

=

= +

= +

=

=

From the simplified equations

= +

= +

=

=

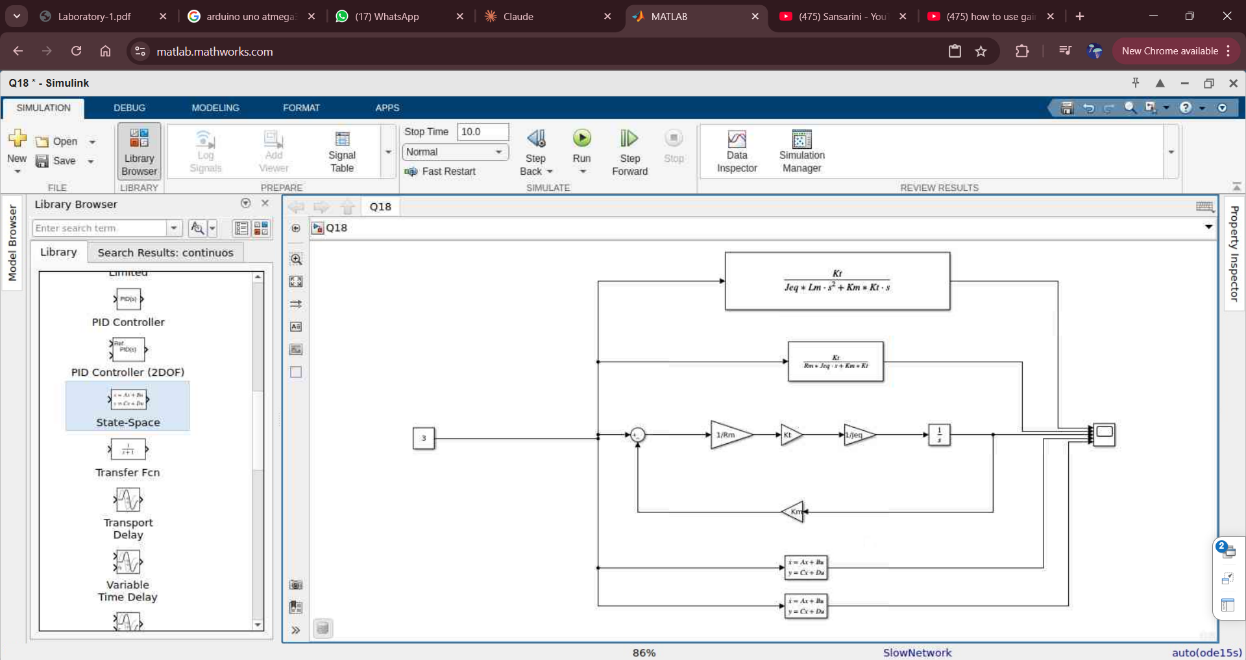
1. 

Figure : Simulink for combination of the state space vector, transfer function

Q2.

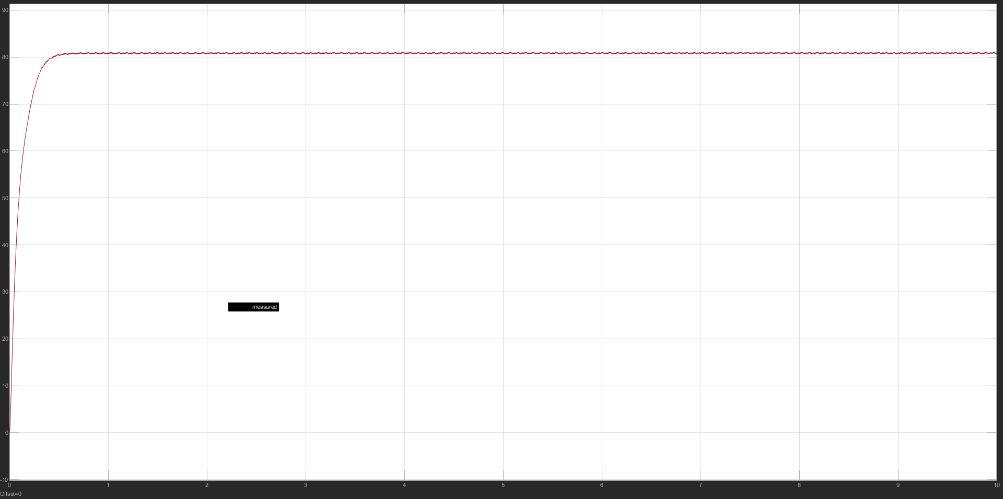


Figure : Speed Response in the Model

A screen shot of a white sheet

Description automatically generated

Figure : Comparing of the Speed Response with Model and State Vector

1. According to my knowledge I think the basic thing for happening those kind of the error is negiligence of the resistance where having in the rotor and also mathlab is the software which required the best performance of the computers so considering the computers which has been used there can be errors as the performance.

Q3)

1.

A graph on a white surface

Description automatically generated

Figure : The Speed Response when KP=1

2.

Steady State Error: 1-0.938 : 0.062

3.

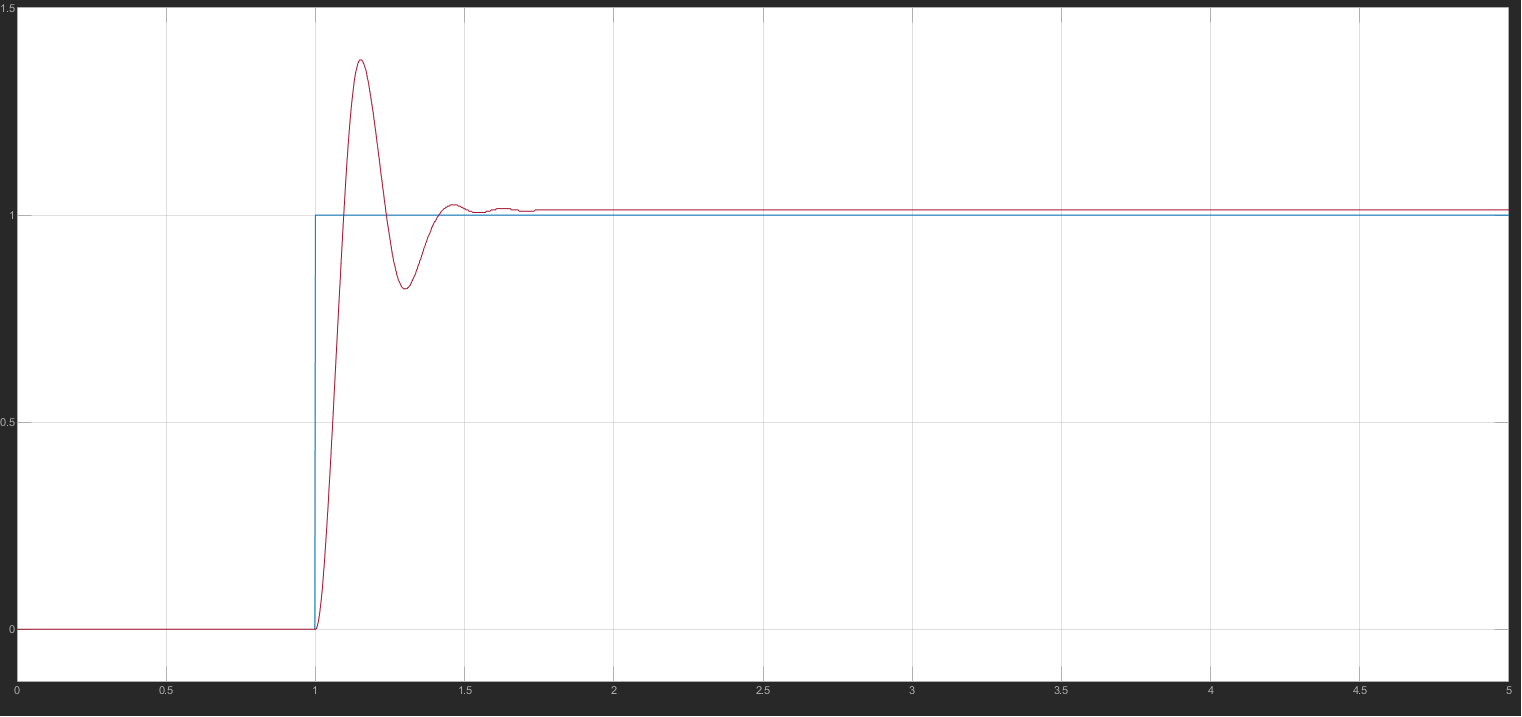


Figure : Speed Response from Simulink when KP=1.25

According to the Figure 5 when Kp = 1.25,

Steady state error = 1-1.012 =0.012

A screen shot of a graph

Description automatically generated.

Figure : Speed Response from Simulink when KP=1.50

According to the Figure 6 when Kp = 1.5,

Steady state error = 1-1.009 = 0.009

A screen shot of a graph

Description automatically generated

Figure : Speed Response from Simulink when KP=1.75

According to the Figure 7 when Kp = 1.75,

Steady state error = 1-0.96 = 0.04

A graph on a screen

Description automatically generated

Figure : Speed Response from Simulink when KP=2.0

According to the Figure 8 when Kp = 2,

Steady state error = 3.35 × 10-2

# REFERENCES

|  |  |
| --- | --- |
| [1] | M. H. Center. [Online]. Available: https://in.mathworks.com/matlabcentral/answers/292859-how-to-find-kp-ki-kd-values-from-transfer-function?requestedDomain=. |
| [2] | "Write Gate University," [Online]. Available: https://cecs.wright.edu/~krattan/courses/419/lecture5.pdf. |