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## EN3143: Electronic Control Systems

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Exercise Number: 3

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### Problem 1

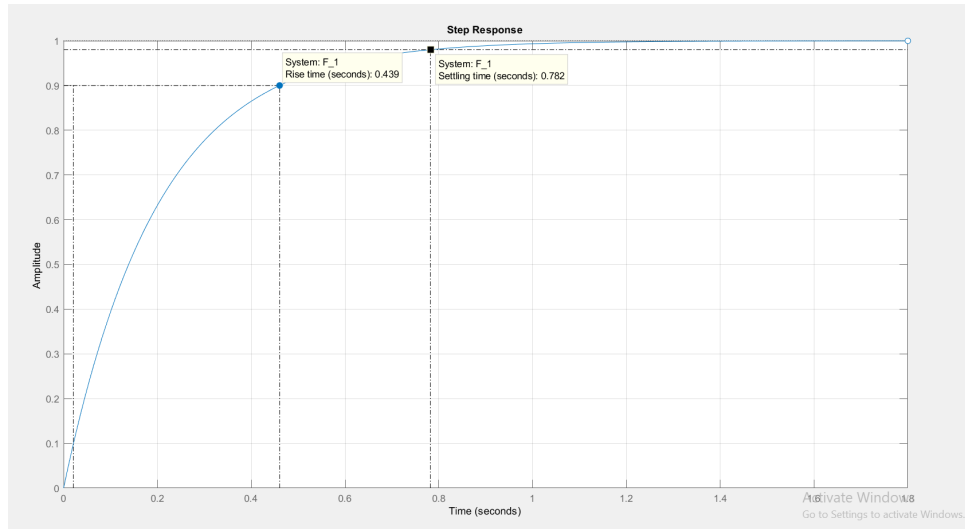


Figure 1: MATLAB plot for step response of the transfer function  $\frac{5}{s+5}$

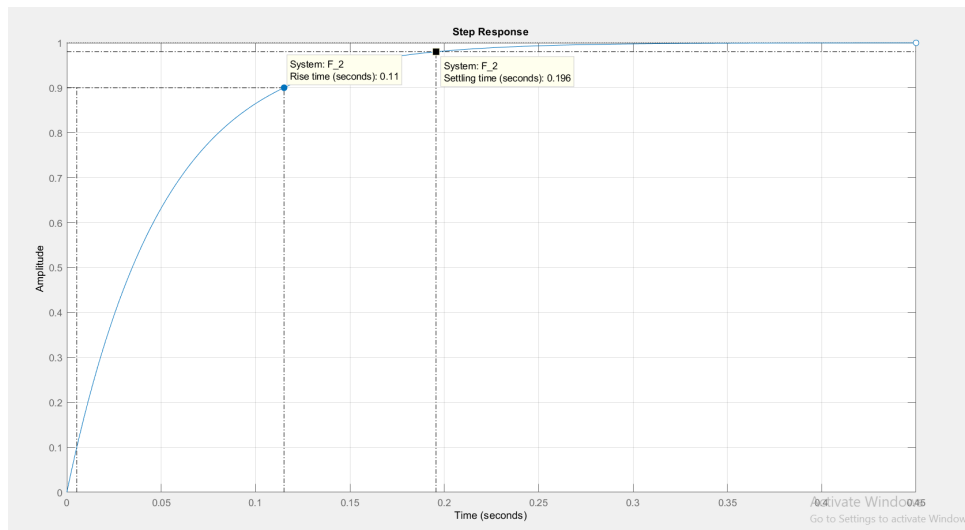


Figure 2: MATLAB plot for step response of the transfer function  $\frac{20}{s+20}$

## Problem 2

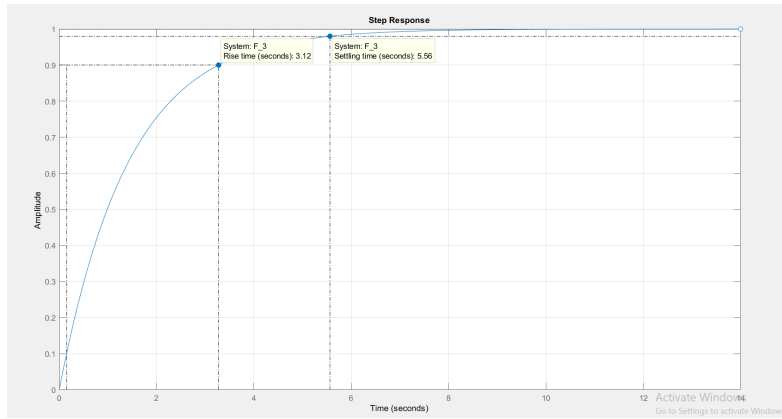


Figure 3: MATLAB plot for step response of the transfer function  $\frac{1}{1.422s+1}$

Obtained values for performance specifications using MATLAB implementation (Code is attached in Appendix) :

- Settling Time = 5.56s
- Rise Time = 3.12s
- Time Constant = 1.39s

Obtained values for performance specifications using solved equations (Calculations are shown in the latter part of the document):

- Settling Time = 5.688s
- Rise Time = 3.1284s
- Time Constant = 1.422s

## Problem 3

When  $M = 1$ ,

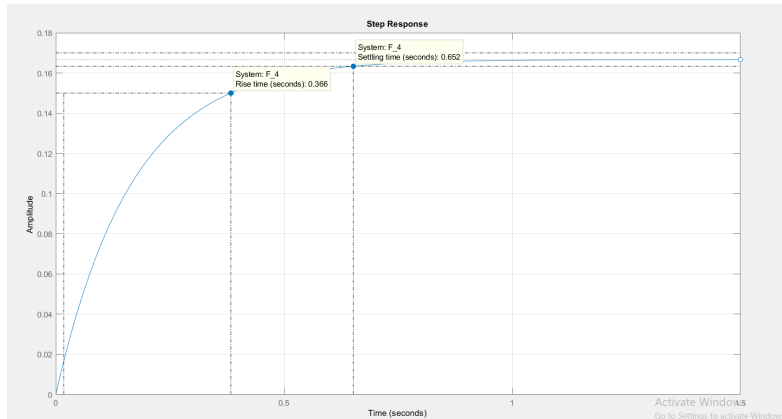


Figure 4: MATLAB plot for step response of the transfer function  $\frac{1}{s+6}$  when  $M = 1$

Obtained values for performance specifications using MATLAB implementation (Code is attached in Appendix):

- Settling Time = 0.652s
- Rise Time = 0.366s
- Time Constant = 0.163s

Obtained values for performance specifications using solved equations (Calculations are shown in the latter part of the document):

- Settling Time = 0.667s
- Rise Time = 0.367s
- Time Constant = 0.167s

When  $M = 2$ ,

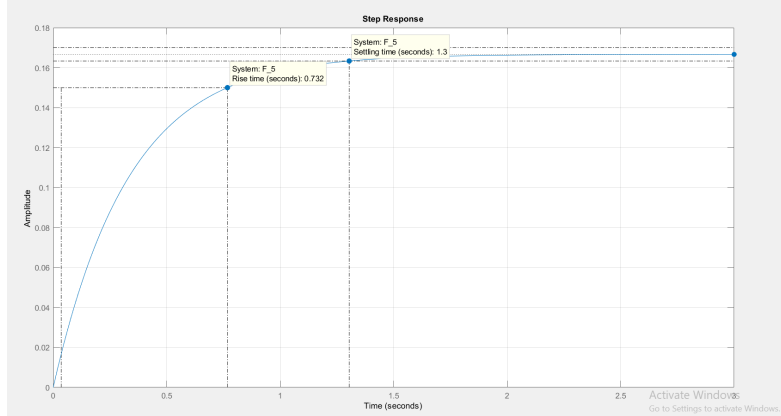


Figure 5: MATLAB plot for step response of the transfer function  $\frac{1}{2s+6}$  when  $M = 2$

Obtained values for performance specifications using MATLAB implementation (Code is attached in Appendix) :

- Settling Time = 1.3s
- Rise Time = 0.732s
- Time Constant = 0.325s

Obtained values for performance specifications using solved equations (Calculations are shown in the latter part of the document):

- Settling Time = 1.333s
- Rise Time = 0.733s
- Time Constant = 0.333s

## Appendix: MATLAB Implementation

```
clc;
close all;
%Problem1
num = [5];
den = [1 5];
F_1 = tf(num, den)
stepplot(F_1); %plot step response of the transfer function

num = [20];
den = [1 20];
F_2 = tf(num, den)
stepplot(F_2); %plot step response of the transfer function

%Problem2
num = [1];
den = [1.422 1];
F_3 = tf(num, den)
stepplot(F_3); %plot step response of the transfer function

%Problem3
%When M=1
num = [1];
den = [1 6];
F_4 = tf(num, den)
stepplot(F_4); %plot step response of the transfer function

%When M=2
num = [1];
den = [2 6];
F_5 = tf(num, den)
stepplot(F_5); %plot step response of the transfer function
```

Figure 6: MATLAB implementation for Problem 1, Problem 2 and Problem 3