

EXPERMINT No. I

Response Of First Order System

Unit-Step Response of the Transfer-Function system can found in two ways :

1.1 Find the response of first order system with unit step input

$$G = \frac{10}{s+5}$$

The image shows a handwritten derivation for the unit-step response of a first-order system. It starts with the transfer function $G = \frac{10}{s+5}$. The goal is to find the response with a unit step input. The output $C(s)$ is given by $\frac{C(s)}{R(s)} = \frac{10}{s+5}$. For a unit step input, $R(s) = \frac{1}{s}$. Therefore, $C(s) = \frac{10}{s+5} \cdot \frac{1}{s}$. Using the partial fraction method, $C(s) = \frac{A}{s+5} + \frac{B}{s}$. This is equated to $\frac{10}{s(s+5)} = \frac{As + Bs + 5B}{s(s+5)}$. Solving for the constants, $A + B = 0$ and $5B = 10$, which gives $B = 2$ and $A = -2$. Finally, taking the inverse Laplace transform, the time-domain response is $c(t) = -2e^{-5t} + 2$.

```
clear all
close all
clc

t=0:0.1:5      %time invariant
C=-2*exp(-5*t)+2; %Response pf the first order system
plot(t,C)      %ploting of the response
```

1.2 By using step command

```
clear all
close all
clc

t=0:0.1:5      %time invariant
num=[10];
den=[1 5];
g=tf(num,den)
step(g,t)
```

Unit-Impulse Response of the Transfer-Function System can be in two ways:

2.1 find the response of first order system with unit impulse input

$$G = \frac{10}{s+5}$$

Handwritten derivation showing the unit impulse response of a first-order system. The transfer function is given as $G = \frac{10}{s+5}$. The response is found by setting the input $R(s) = 1$, resulting in $C(s) = \frac{10}{s+5}$. The inverse Laplace transform is then taken to yield the time-domain response $C(t) = 10e^{-5t}$.

```
clear all
close all
clc

t=0:0.1:5      %time invariant
C=10*exp(-5*t); %Response pf the first order system
plot(t,C)      %ploting of the responce
```

2.2 By using step command

```
clear all
close all
clc

t=0:0.1:5      %time invariant
num=[10];
den=[1 5];
g=tf(num,den);
impulse(g,t)
```

Unit-Ramp Response of the Transfer-Function System can be in two ways:

3.1 find response of first order system with unit ramp input

$$G = \frac{10}{s+5}$$

The image shows a handwritten derivation for the unit-ramp response of a first-order system. It starts with the transfer function $G = \frac{10}{s+5}$. The goal is to find the response $C(s)$ for a unit ramp input $R(s) = \frac{1}{s^2}$. The derivation uses the partial fraction method to decompose the product $\frac{10}{s^2(s+5)}$ into $\frac{A}{s+5} + \frac{B}{s} + \frac{C}{s^2}$. By equating the numerators, the constants are found to be $A = 0.4$, $B = -0.4$, and $C = 2$. Finally, the inverse Laplace transform is taken to yield the time-domain response $c(t) = 0.4e^{-5t} - 0.4 + 2t$.

$$G = \frac{10}{s+5}$$

Find the response of first order system with Unit ramp Input

$$\frac{C(s)}{R(s)} = \frac{10}{s+5}$$

Unit ramp input $R(s) = \frac{1}{s^2}$

$$C(s) = \frac{10}{s+5} \cdot \frac{1}{s^2}$$

Using partial fraction method

$$= \frac{A}{s+5} + \frac{B}{s} + \frac{C}{s^2}$$
$$\frac{10}{s^2(s+5)} = \frac{As^2 + B(s^2+5s) + C(s+5)}{s^2(s+5)}$$
$$\frac{10}{s^2(s+5)} = \frac{As^2 + Bs^2 + 5Bs + Cs + 5C}{s^2(s+5)}$$
$$10 = 5C \Rightarrow C = 2$$
$$5B + C = 0 \Rightarrow B = -0.4$$
$$A + B = 0 \Rightarrow A = 0.4$$

Taking inverse Laplace

$$c(t) = 0.4e^{-5t} - 0.4 + 2t$$

```
close all
clc

t=0:0.1:10; %time invariati
C=0.4*exp(-5*t)-0.4+2*t; %Responce pf the first order
system
plot(t,C)
```

3.2 By using step command

```
clear all
close all
clc

s=tf('s');
t=0:0.1:5 %time invariant
num=[10];
den=[1 5];
g=tf(num,den)
step(g/s,t)
```