

Frequency Domain

Modeling

Lab: 08



Fall 2022

CSE-3L Control Systems

Submitted by: **Amir Suliman**

Registration No: **19PWCSE1805**

Class Section: **B**

“On my honor, as a student of the University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work.”

Student Signature: _____

Submitted to:

Dr: Muniba Ashfaq

December 27, 2022

Department of Computer Systems Engineering

University of Engineering and Technology, Peshawar

Objectives:

- To Know about residue.
- To know about inverse laplace transform.
- To know about matlab tool box.

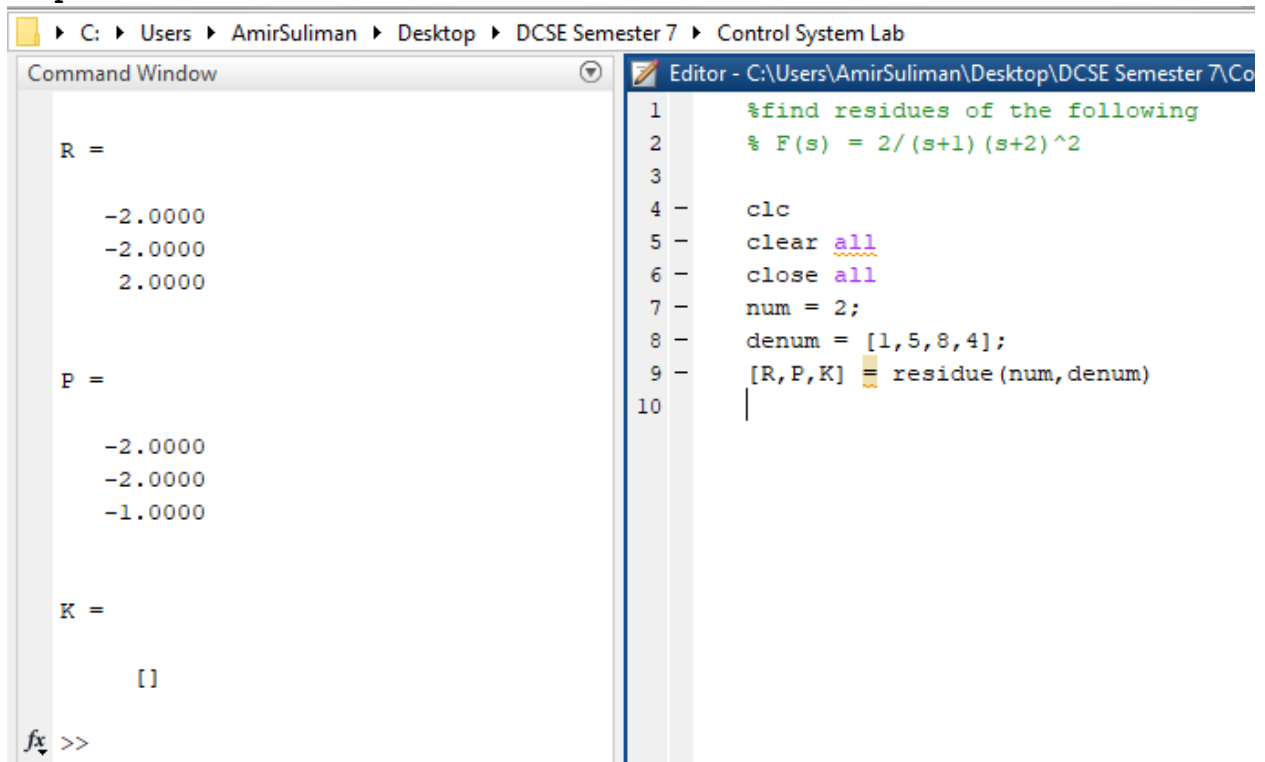
Task 01:

find residues of the following
 $F(s) = 2/(s+1)*(s+2)^2$

Code :

```
clc
clear all
close all
num = 2;
denum = [1,5,8,4];
[R,P,K] = residue(num,denum)
```

Output:



The screenshot displays the MATLAB environment. The Command Window on the left shows the results of the residue calculation:

```
R =  
    -2.0000  
    -2.0000  
     2.0000  
  
P =  
    -2.0000  
    -2.0000  
    -1.0000  
  
K =  
    []
```

The Editor on the right shows the MATLAB script used to calculate the residues:

```
1 %find residues of the following  
2 % F(s) = 2/(s+1)(s+2)^2  
3  
4 clc  
5 clear all  
6 close all  
7 num = 2;  
8 denum = [1,5,8,4];  
9 [R,P,K] = residue(num,denum)  
10
```

Task 02:

Find residues of the following
 $F(s) = 2/s(s+1)(s+2)$

Code :

```
clc
```

```
clear all
close all
num = 3;
denum = [1,2,5,0];
[R,P,K] = residue(num,denum)
```

Output:

The screenshot shows the MATLAB environment. The Command Window on the left displays the results of the `residue` function. The Editor on the right shows the script being executed.

Command Window Output:

```
R =
    2.5000
   -5.0000
    2.5000

P =
   -3.0000
   -2.0000
   -1.0000

K =
    []
```

Editor Script:

```
1 %find residues of the following
2 % F(s) = 2/s(s+1)(s+2)
3
4 clc
5 clear all
6 close all
7 num = 3;
8 denum = [1,2,5,0];
9 [R,P,K] = residue(num,denum)
10
```

Task 03:

find residues of the following

$$F(s) = 5/(s+1)(s+2)(s+3)$$

Code:

```
clc
clear all
close all
num = 5;
denum = [1,6,11,6];
[R,P,K] = residue(num,denum)
```

Output:

Command Window

```
R =  
  
    2.5000  
   -5.0000  
    2.5000  
  
P =  
  
   -3.0000  
   -2.0000  
   -1.0000  
  
K =  
  
    []  
  
fx >>
```

Editor - C:\Users\AmirSuliman\Desktop\DCSE Semester 7

```
1 %find residues of the following  
2 % F(s) = 5/(s+1)(s+2)(s+3)  
3  
4 clc  
5 clear all  
6 close all  
7 num = 5;  
8 denum = [1,6,11,6];  
9 [R,P,K] = residue(num,denum)  
10
```

Task 04:

```
% find inverse laplace transform  
% of the following symbolic toolbox  
% F(s) = 1/s(s+1)
```

Code :

```
clc  
clear all  
close all  
syms s  
c = 1/(s*(s+2));  
c = ilaplace(c)  
pretty(c)
```

output:

Command Window

```
c =
1/2 - exp(-2*t)/2
1 exp(-2 t)
- - -
2      2
```

fx >>

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```
1 % find inverse laplace transform
2 % of the following symbolic toolbox
3 % F(s) = 1/s(s+1)
4
5 clc
6 clear all
7 close all
8 syms s
9 c = 1/(s*(s+2));
10 c = ilaplace(c)
11 pretty(c)
```

Task 05:

```
% find inverse laplace transform
% of the following symbolic toolbox
% F(s) = 2/(s+1)(s+2)^2
```

Code:

```
clc
clear all
close all
syms s
c = 2/((s+1)*(s+2)^2);
c = ilaplace(c)
pretty(c)
```

OutPut:

Command Window

```
c =
2*exp(-t) - 2*exp(-2*t) - 2*t*exp(-2*t)
2 exp(-t) - exp(-2 t) 2 - t
exp(-2 t) 2
```

fx >>

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```
1 % find inverse laplace transform
2 % of the following symbolic toolbox
3 % F(s) = 2/(s+1)(s+2)^2
4
5 clc
6 clear all
7 close all
8 syms s
9 c = 2/((s+1)*(s+2)^2);
10 c = ilaplace(c)
11 pretty(c)
```

Task 06:

```
% find inverse laplace transform
% of the following symbolic toolbox
% F(s) = 2/s(s+1)(s+2)
```

Code:

```
clc
clear all
close all
syms s
c = 3/(s*(s^2+2*s+5));
c = ilaplace(c)
pretty(c)
```

output:

The screenshot shows the MATLAB environment. The Command Window on the left displays the result of the inverse Laplace transform calculation. The Editor on the right shows the code used to perform the calculation.

Command Window Output:

$$c = \frac{3}{5} - \frac{(3 \exp(-t) (\cos(2t) + \frac{\sin(2t)}{2}))}{5}$$

Editor Code:

```
1 % find inverse laplace transform
2 % of the following symbolic toolbox
3 % F(s) = 2/s(s+1)(s+2)
4 clc
5 clear all
6 close all
7 syms s
8 c = 3/(s*(s^2+2*s+5));
9 c = ilaplace(c)
10 pretty(c)
```

Task 07:

```
% find inverse laplace transform
% of the following symbolic toolbox
% F(s) = 5/(s+1)(s+2)(s+3)
```

Code:

```
clc
clear all
close all
syms s
c = 5/((s+1)*(s+2)*(s+3));
c = ilaplace(c)
pretty(c)
```

Output:

Command Window

```
c =
(5*exp(-t))/2 - 5*exp(-2*t) + (5*exp(-3*t))/2

5 exp(-t)      exp(-3 t) 5
----- - exp(-2 t) 5 + -----
2              2
```

fx >>

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```
1 % find inverse laplace transform
2 % of the following symbolic toolbox
3 % F(s) = 5/(s+1)(s+2)(s+3)
4
5 clc
6 clear all
7 close all
8 syms s
9 c = 5/((s+1)*(s+2)*(s+3));
10 c = ilaplace(c)
11 pretty(c)
```

Task 08:

% use matlab and symbolic tool box to help you find the values of carsents

```
% V(s) = (2*s + 2)*I1(s) - (2*s + 1)*I2(s) - I3(s)
% -1*(2*s + 2)*I1(s) + (9*s + 1)*I2(s) - 4*s*I3(s) = 0
% -1*(2*s + 2)*I1(s) + (9*s + 1)*I2(s) - 4*s*I3(s) = 0
```

Code:

```
clc
clear all
close all
syms s
syms I1
syms I2
syms I3 V

A = [(2*s + 2), -(2*s + 1), -1;
     -1*(2*s + 2), (9*s + 1), -4*s;
     -1, -4*s, (4*s+1+1/s)];

B = [I1; I2; I3];
C = [V; 0; 0];
B = inv(A)*(C);
pretty(B)
```

output:

Command Window

B =

```
(V*(20*s^3 + 13*s^2 + 10*s + 1))/(s*(24*s^3 + 22*s^2 + 7*s + 13))
(2*V*(4*s^3 + 7*s^2 + 2*s + 1))/(s*(24*s^3 + 22*s^2 + 7*s + 13))
(V*(8*s^2 + 17*s + 1))/(24*s^3 + 22*s^2 + 7*s + 13)
```

```
/      3      2      \
| V (20 s  + 13 s  + 10 s + 1) |
| ----- |
|      s #1      |
|      |      |
|      3      2      |
| V (4 s  + 7 s  + 2 s + 1) 2 |
| ----- |
|      s #1      |
|      |      |
|      2      |
| V (8 s  + 17 s + 1)      |
| ----- |
|      #1      |
\      /
```

where

```
      3      2
#1 == 24 s  + 22 s  + 7 s + 13
```

fx >>