Contents


```
%Tyler Matthews
%System Simluation Midterm P4
clc; close all; %Clear console and close figures
```

PART A

```
disp('Corrector is fourth order accurate because up to C3 in Lambert''s equations are equal to
 0');
```

```
Corrector is fourth order accurate because up to C3 in Lambert's equations are equal to 0
```

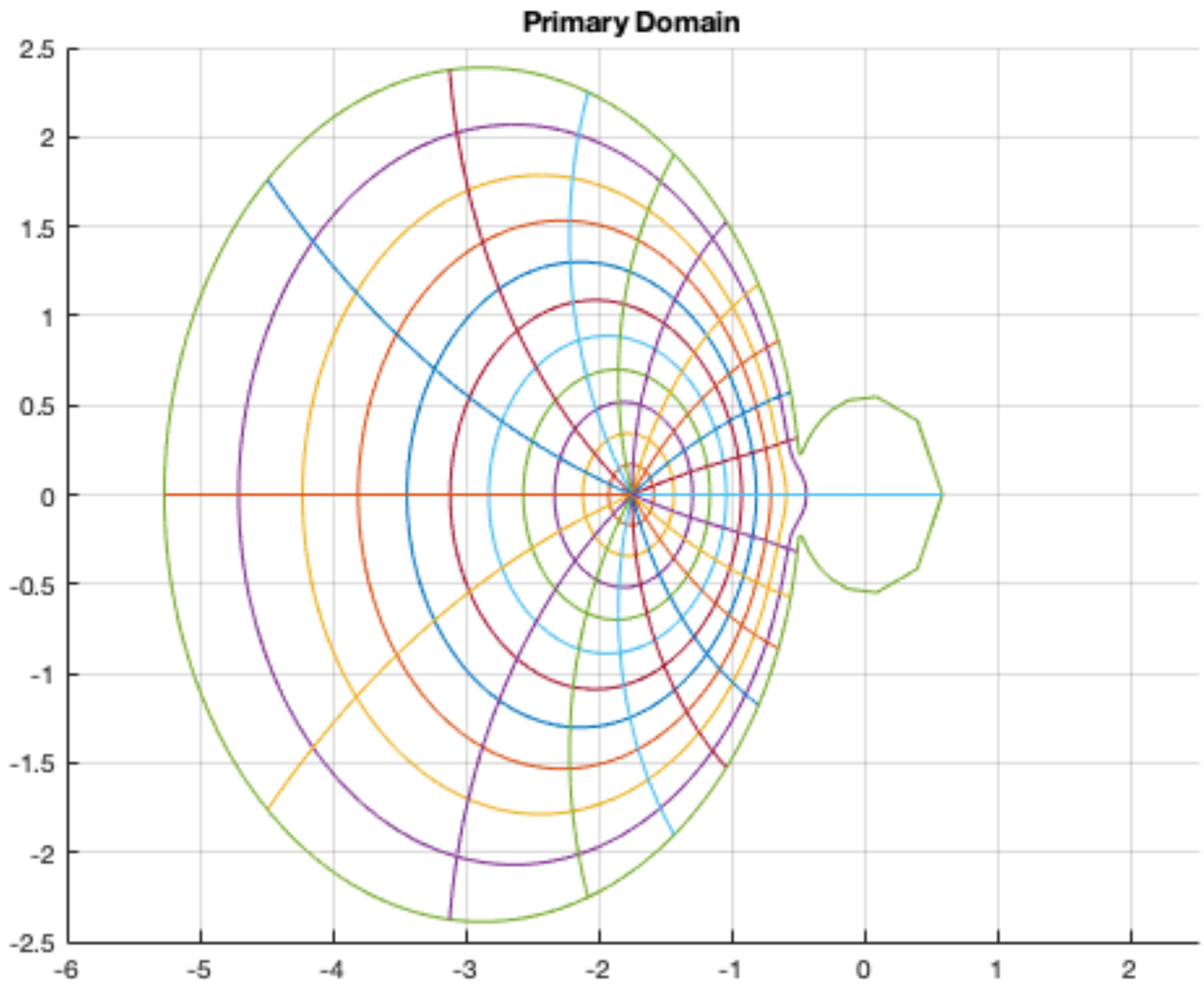
PART C

```
Nt=21;
Nr=12;

num = [0.46 0.29 -0.32]
den = [1 -1.56 0.56]

Hp = tf(num, den)
zeros = roots(num)
poles = roots(den)

Phi = tf(den, num) %(sigma / roe) : (row - 1*sigma)

newNum = [10076 -11552 3368]
badPoints = roots(newNum)
magnitude = abs(badPoints)

theta=linspace(0,2*pi,1001);
rho=linspace(0,0.5686,1001);
tvec=linspace(0,2*pi,Nt);
rvec=linspace(0,0.5686,Nr);

temp = (roots(den - num*0.5764));
mag = abs(temp)
ang = angle(temp)

for k=1:length(rvec)
 z=rvec(k)*exp(i*theta);
 w = (z.^2-z.*1.56 + 0.56)./(z.^2.*0.46+z.*0.29-0.32);
 hold on
```

```
 plot(real(w), imag(w))
 hold off
end

for k=1:length(tvec)-1
 z=rho*exp(i*tvec(k));
 w = (z.^2-z.*1.56 + 0.56)./(z.^2.*0.46+z.*0.29-0.32);
 hold on
 plot(real(w), imag(w))
 hold off
end

grid on
axis([-6 2.5 -2.5 2.5])
title('Primary Domain')

%TESTING FOR INTERSECTION POINT
% for N=1:10
%     temp =  0.568 + N*0.0001
%     val = sprintf('N = %0.5f',temp);
%     z = (temp) * exp(i*theta);
%     w = (z.^2-z.*1.56 + 0.56)./(z.^2.*0.46+z.*0.29-0.32);
%     plot(real(w), imag(w));
%     title(val);
%     disp(val);
%     disp(w(1));
%     disp(w(2));
%     pause;
% end
```

```
num =

    0.4600    0.2900   -0.3200


den =

    1.0000   -1.5600    0.5600


Hp =

  0.46 s^2 + 0.29 s - 0.32
  ------------------------
    s^2 - 1.56 s + 0.56

Continuous-time transfer function.


zeros =

   -1.2069
    0.5764
```

```
poles =

    1.0000
    0.5600


Phi =

    s^2 - 1.56 s + 0.56
  ------------------------
  0.46 s^2 + 0.29 s - 0.32

Continuous-time transfer function.


newNum =

       10076      -11552        3368


badPoints =

   0.5732 + 0.0752i
   0.5732 - 0.0752i


magnitude =

    0.5782
    0.5782


mag =

    1.7818
    0.5686


ang =

     0
     0
```

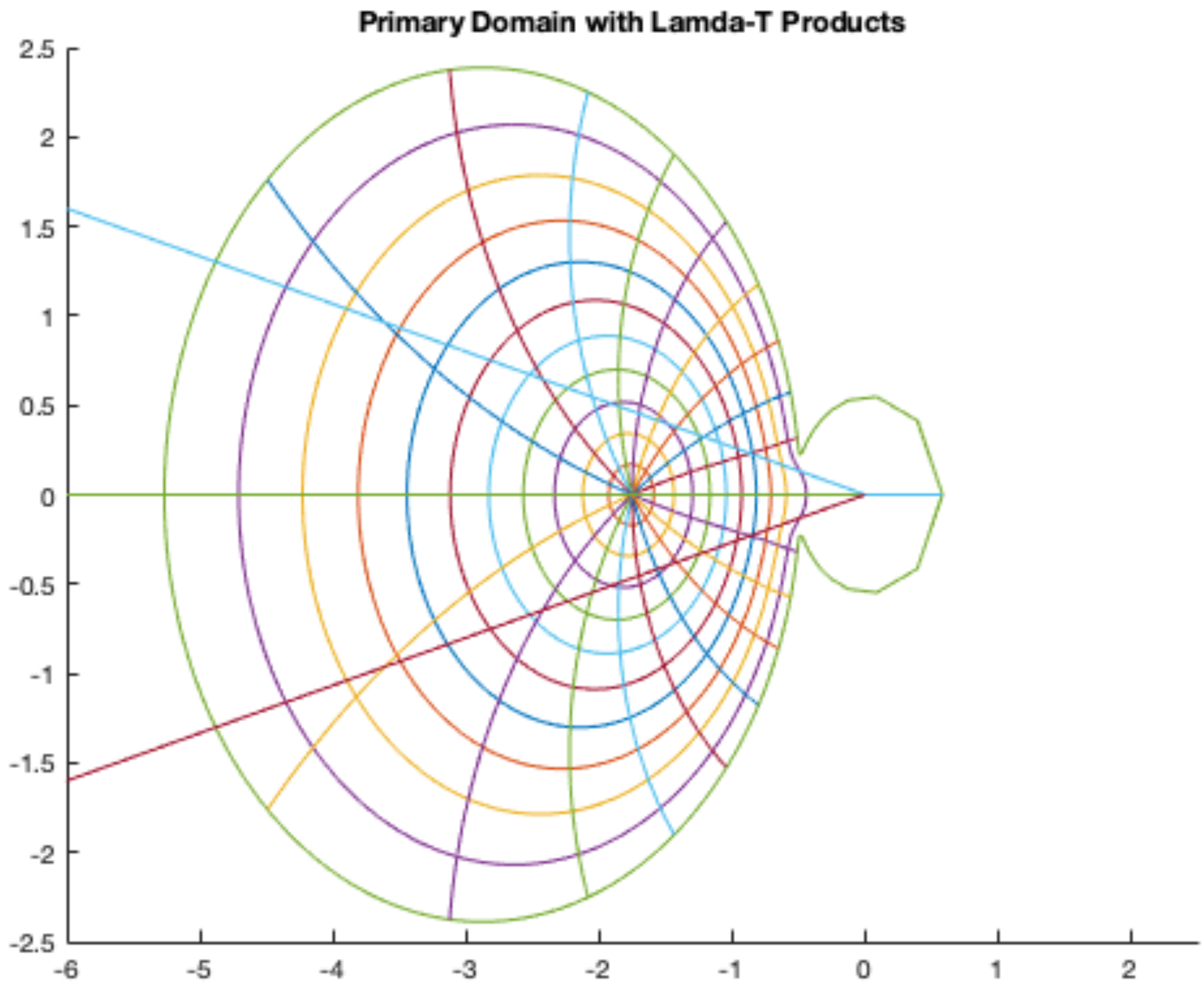


PART D

```
%Getting an actual value for T using the state-space representation in
%problem 03

A = [-4.7, -1.55, -0.55; 0.3, -2.75, -0.35; 1.1, 1.85, -2.55]
B = [1; 0; -1]
C = [2, 1, 1]
D = [0]

lamda = eig(A)

figure;

for k=1:length(rvec)
 z=rvec(k)*exp(i*theta);
 w = (z.^2-z.*1.56 + 0.56)./(z.^2.*0.46+z.*0.29-0.32);
 hold on
 plot(real(w), imag(w))
 hold off
end

for k=1:length(tvec)-1
 z=rho*exp(i*tvec(k));
 w = (z.^2-z.*1.56 + 0.56)./(z.^2.*0.46+z.*0.29-0.32);
 hold on
 plot(real(w), imag(w))
 hold off
end
```

```
axis([-6 2.5 -2.5 2.5])
title('Primary Domain with Lamda-T Products')
T = linspace(0,2,1001);

hold on
plot(real(lamda(1)*T), imag(lamda(1)*T))
plot(real(lamda(2)*T), imag(lamda(2)*T))
plot(real(lamda(3)*T), imag(lamda(3)*T))
hold off

disp('Stable, and accurate, values for T would be located inside of the green incompassing lin
e and to the right of the plot''s origin (-1.75, 0)')
disp('The best points would be between -1 & -1.75 on the x-axis and between 1 & -1 on the y-ax
is')
disp('Using lamda-T products from Problem 3, this would give us T = 0.23')
```

```
A =

   -4.7000   -1.5500   -0.5500
    0.3000   -2.7500   -0.3500
    1.1000    1.8500   -2.5500


B =

     1
     0
    -1


C =

     2     1     1


D =

     0


lamda =

  -4.0000 + 0.0000i
  -3.0000 + 0.8000i
  -3.0000 - 0.8000i

Stable, and accurate, values for T would be located inside of the green incompassing line and
to the right of the plot's origin (-1.75, 0)
The best points would be between -1 & -1.75 on the x-axis and between 1 & -1 on the y-axis
Using lamda-T products from Problem 3, this would give us T = 0.23
```

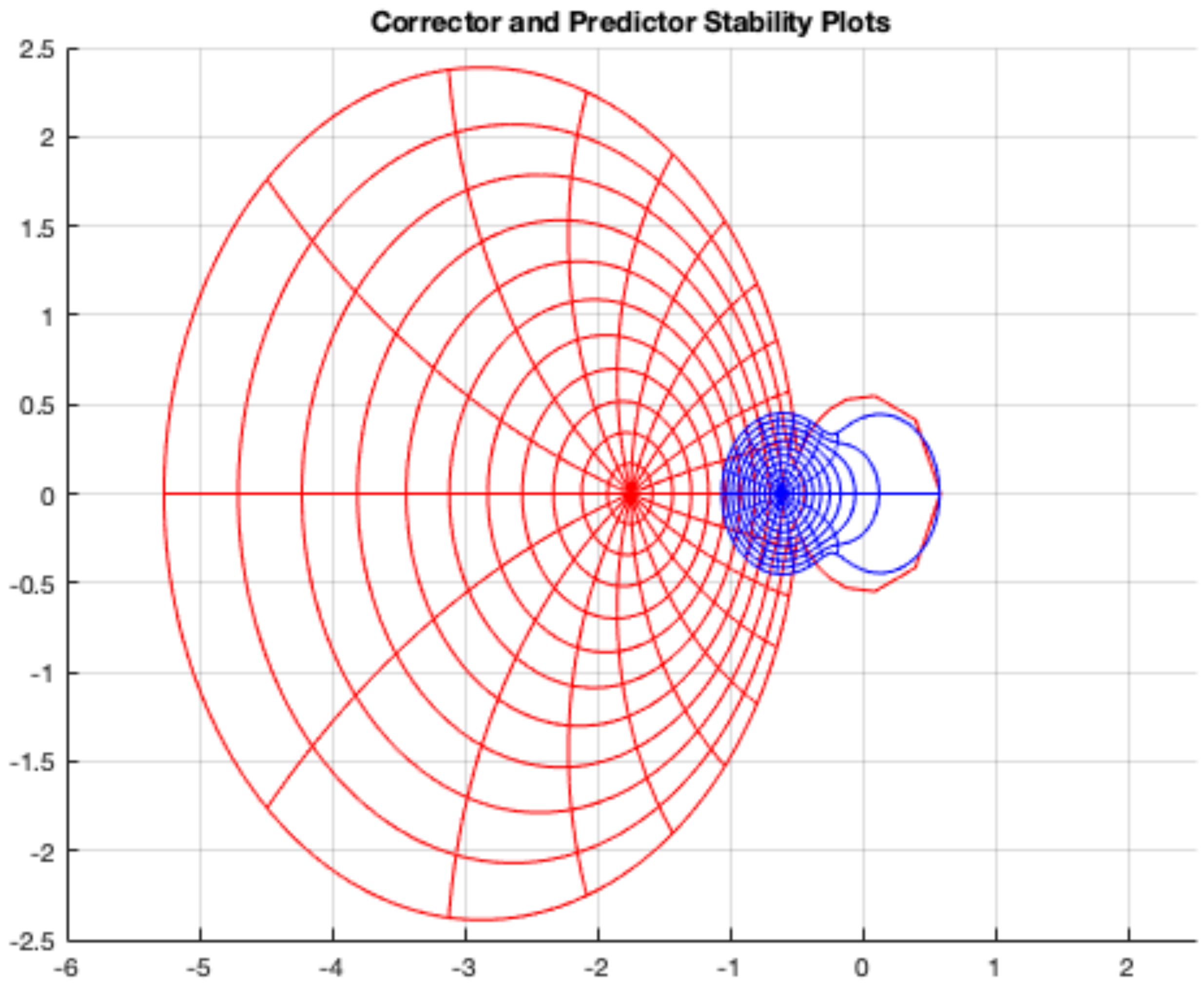


PART E

```
figure;

for k=1:length(rvec)
 z=rvec(k)*exp(i*theta);
 w = (z.^2-z.*1.56 + 0.56)./(z.^2.*0.46+z.*0.29-0.32);
 hold on
 plot(real(w), imag(w), 'r')
 hold off
end

for k=1:length(tvec)-1
 z=rho*exp(i*tvec(k));
 w = (z.^2-z.*1.56 + 0.56)./(z.^2.*0.46+z.*0.29-0.32);
 hold on
 plot(real(w), imag(w), 'r')
 hold off
end

theta=linspace(0,2*pi,1001);
rho=linspace(0,0.5256,1001);
tvec=linspace(0,2*pi,Nt);
rvec=linspace(0,0.5256,Nr);


for k=1:length(rvec)
 z=rvec(k)*exp(i*theta);
 w=(z.^2-z.*1.45 + 0.45)./(z.*1.27-0.73);
```

```
 hold on
 plot(real(w), imag(w), 'b')
 hold off
end

for k=1:length(tvec)-1
 z=rho*exp(i*tvec(k));
 w=(z.^2-z.*1.45 + 0.45)./(z.*1.27-0.73);
 hold on
 plot(real(w), imag(w), 'b')
 hold off
end


grid on
axis([-6 2.5 -2.5 2.5])
title('Corrector and Predictor Stability Plots')

disp(' ')
disp('Stability plot for the predictor is in blue and the stability plot for corrector is in r
ed')
disp('You can see that the plots are similiar, but the corrector plot is much larger and shift
ed to the left')
```

```
Stability plot for the predictor is in blue and the stability plot for corrector is in red
You can see that the plots are similiar, but the corrector plot is much larger and shifted to
the left
```


Corrector and Predictor Stability Plots
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-6
-5
-4
-3
-2
-1
0
1
2