

Matt McDade
System Simulation
Midterm Problem 2

$$H_p(z) = \frac{T \left(\frac{14}{11} z - \frac{8}{11} \right)}{z^2 - \frac{16}{11} z + \frac{5}{11}}$$

$$\alpha_2 = 1 \quad \alpha_1 = -\frac{16}{11} \quad \alpha_0 = \frac{5}{11}$$

$$\beta_2 = 0 \quad \beta_1 = \frac{14}{11} \quad \beta_0 = -\frac{8}{11}$$

A) 3rd order accuracy since it satisfies 3 lambert equations

$$B) \text{PLTE}_p[k] = C_p T^{m+1} x^{(m+1)} \approx \frac{C_p}{C_p - C_c} (X_c[k] - X_p[k])$$

$$= \frac{C_p}{C_p - C_c} (x_c - x_p)[k-1]$$

$$C_p = C_3 = \frac{8}{6} + \frac{1}{6} \alpha_1 - 2\beta_2 - \frac{1}{2} \beta_1$$

$$C_c = C_4 = \frac{8}{6} + \frac{1}{6} \left(-\frac{16}{11} \right) - 2(0) - \frac{1}{2} \left(\frac{14}{11} \right)$$

$$= \frac{5}{11}$$

$$C_c = C_4 = \frac{16}{24} + \frac{1}{24} \alpha_1 - \frac{8}{6} \beta_2 - \frac{1}{6} \beta_1$$

$$= \frac{16}{24} + \frac{1}{24} \left(-\frac{236}{151} \right) - \frac{8}{6} \left(\frac{70}{151} \right) - \frac{1}{6} \left(\frac{44}{151} \right)$$

$$= \frac{16}{24} - \frac{59}{906} - \frac{280}{453} - \frac{22}{453}$$

$$= \frac{49}{302}$$

$$\text{PLTE}_p = \frac{C_p}{C_p - C_c} \cdot T = \frac{5}{11} = \frac{1510}{971} = 1.5551T$$

C) See matlab attached

D) secondary domain is not relatively easy to obtain with my transfer function

E) see secondary plot w/ shading

```
% Matt McDade
% System Simulation
% Midterm Exam Problem 2C

Nt=10;
Nr=17;

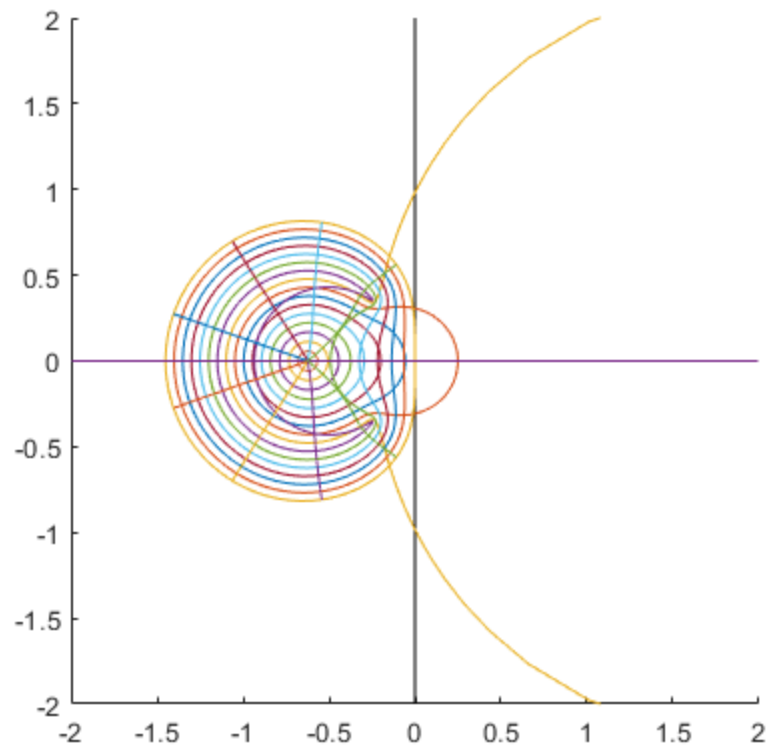
theta=linspace(0,2*pi,1001);
rho=linspace(0,1,1001);

tvec=linspace(0,2*pi,Nt);
rvec=linspace(0,1,Nr);

figure(1)
clf
hold on
    plot(rho*0,4*rho-2,'k')
    plot(4*rho-3,rho*0,'k')
hold off
for k=1:length(rvec)
    z=rvec(k)*exp(i*theta);
    zeta= (z.^2 - (16/11)*z + (5/11)) ./ ((14/11)*z - (8/11));
    hold on
        plot(real(zeta),imag(zeta))
    hold off
end

for k=1:length(tvec)-1
    z=rho*exp(i*tvec(k));
    zeta= (z.^2 - (16/11)*z + (5/11)) ./ ((14/11)*z - (8/11));
    hold on
        plot(real(zeta),imag(zeta))
    hold off
end

axis([-2 2 -2 2])
axis square
```



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E)

