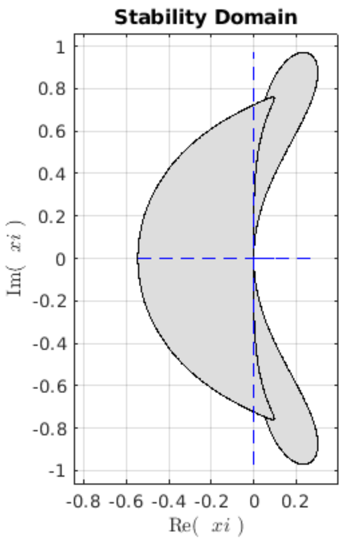
```
clear all;
close all;

%Setting up variables for plotting purposes.
LW =  'LineWidth' ;
lw  =  1;
clr  =  [221  221  221]/255;
xlbl  =  'Re( $\ xi$ )';
ylbl  =  'Im( $\ xi$ )';
intrptr  =  'Interpreter';
ltx  =  'Latex';

%Stability domain for the method.
% Define  the  unit  circle  in  the  complex  plane
N =  1000;
th = linspace(0,2*pi,N);
w = exp(1i*th);

%solution of the characteristic equation in terms of $\xi$
f=@(w) 3*w.*((w.^2)-1)./(7*(w.^2)-2*w+1);
g=@(w) 12*(w.^3 - w.^2)./(23*w.^2 - 16*w + 5);

%Evaluate $f$ at the points on the unit circle and then plot the results:
xi = f(w);

plot(xi, 'k-', LW,lw), hold on
fill (real(xi), imag(xi), clr)
plot([min(real(xi)) max(real(xi))],[0 0],'b--',LW,lw)
plot([0 0], [min(imag(xi)) max(imag(xi))],'b--',LW,lw)
xlabel(xlbl,intrptr, ltx), ylabel(ylbl, intrptr,ltx)
xlim([min(real(xi))-0.3 max(real(xi))+0.3])
ylim([min(imag(xi))-0.3 max(imag(xi))+0.3])

%AB3
xii = g(w);
plot(xii, 'k-', LW,lw), hold on
fill (real(xii), imag(xii), clr)
plot([min(real(xii)) max(real(xii))],[0 0],'b--',LW,lw)
plot([0 0], [min(imag(xii)) max(imag(xii))],'b--',LW,lw)
xlabel(xlbl,intrptr, ltx), ylabel(ylbl, intrptr,ltx)
xlim([min(real(xii))-0.3 max(real(xii))+0.3])
ylim([min(imag(xii))-0.3 max(imag(xii))+0.3])

title('Stability Domain')
grid on

daspect([1 1 1]), hold off

%check for the root condition at a point inside and outside the apperent
%domain.

%compare
xii = 0.2 + 0.8*1i; %inside
xio = 0.2 - 0.4*1i; %outside
coeffii = [1 -7/3*xii (-1+2/3*xii) -xii/3];
coeffio = [1 -7/3*xio (-1+2/3*xio) -xio/3];

ep1=abs(roots(coeffii))
ep2=abs(roots(coeffio))

%for AB3
xiiA = 0.2 + 0.2*1i; %inside
xioA = -0.4 - 0.6*1i; %outside
coeffiiA = [12 (-1-23)*xiiA (16*xiiA) -5*xiiA];
coeffioA = [12 (-1-23)*xioA (16*xioA) -5*xioA];
ep1A=abs(roots(coeffiiA))
ep2A=abs(roots(coeffioA))

%intersection between the two domains
xis = 0.09534 + 0.7597*1i;
xio = 0.2 - 0.4*1i; %outside
coeffiis = [1 -7/3*xis (-1+2/3*xis) -xis/3];
coeffio = [1 -7/3*xio (-1+2/3*xio) -xio/3];

ep1s=abs(roots(coeffiis))
ep2s=abs(roots(coeffio))

fprintf('Compare and Contrast\n')
fprintf('Most of the region of the stability domain for AB3 lines in the negative real part of x and both in the negative and \n positive imagina

fprintf('Would you ever want to use this method?\n');

fprintf('I would never want to use this method because checking for root condition at the point\n inside to and outside to the apparent domain, a
```

```
ep1 =

    1.1710
    1.1915
    0.1970


ep2 =

    1.2252
```

```
    0.8707
    0.1397


ep1A =

    0.7233
    0.4436
    0.3673


ep2A =

    1.8750
    0.4071
    0.3936


ep1s =

    1.3172
    1.0454
    0.1853


ep2s =

    1.2252
    0.8707
    0.1397

Compare and Contrast
Most of the region of the stability domain for AB3 lines in the negative real part of x and both in the negative and
 positive imaginary part of x, while for the other LMS method, the satbility domain lies in the positive real part of x and also both in the posi
 imaginery part of x. However these two have a region in common.
Would you ever want to use this method?
I would never want to use this method because checking for root condition at the point
 inside to and outside to the apparent domain, at least one root has a modulus greater
 than one, hence the method  is unconditionally unstable for all episilon, inside and
 outside the domain.
```



Published with MATLAB® R2020a