Kelley Stanka MATH246

Matlab Source Code

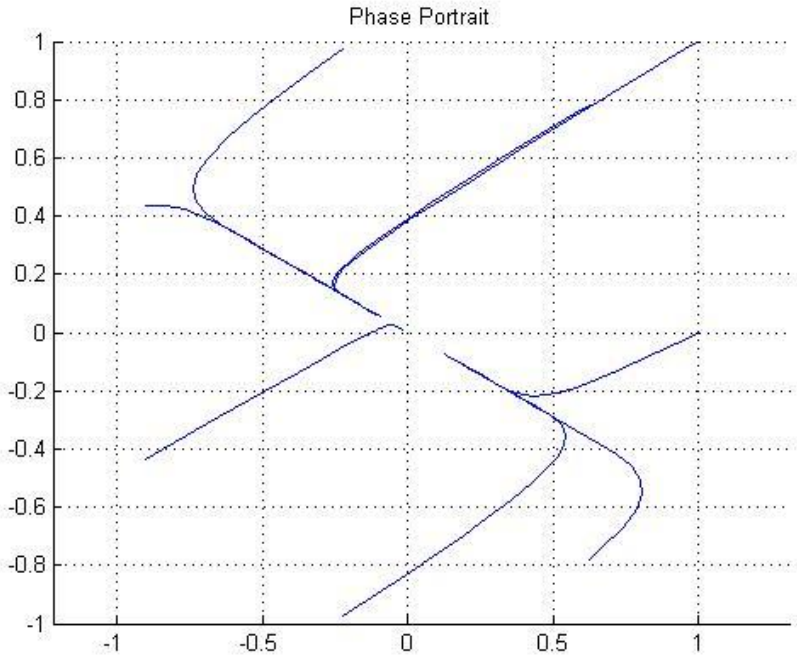
```
%%
%Extra Credit MATH246
global AA
AA = [-2 -3;-1 -2];
tspan = [0 -5];
Va = [-1 1 -1 1]; axis(Va), axis equal, hold on, grid
u0 = [1;1];
[t,u] = ode23(@lin, tspan, u0); plot(u(:,1),u(:,2))
n = 7
st = exp(i*2*pi*(1:n)/n);
for s = st
   u0 = [real(s);imag(s)];
   [t,u] = ode23(@lin, tspan, u0); plot(u(:,1) ,u(:,2));
end
title 'Phase Portrait'
```

In this case, mu is equivalent to -2. The following graphs show how the portraits change as mu goes from -2 to 2.

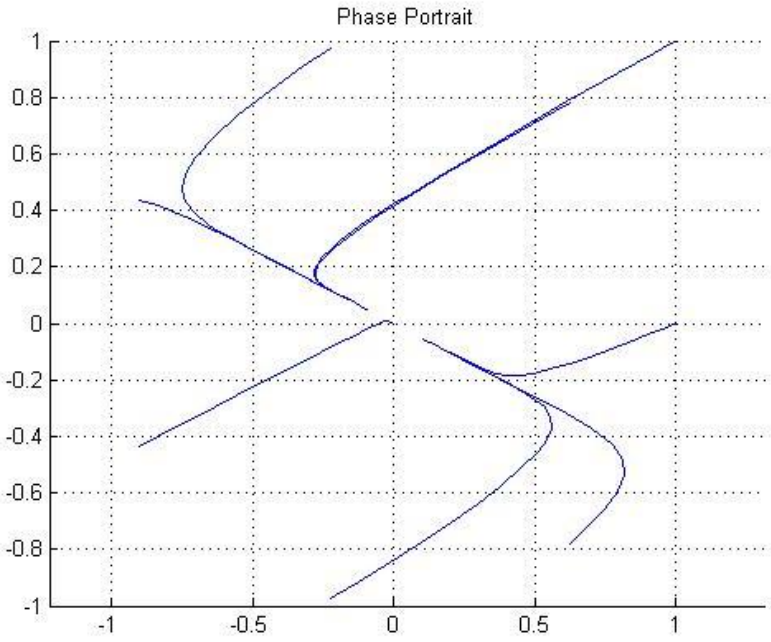
a_{11} = mu , a_{12} = mu - 1 , a_{21} = mu + 1 , a_{22} = mu

Graphs

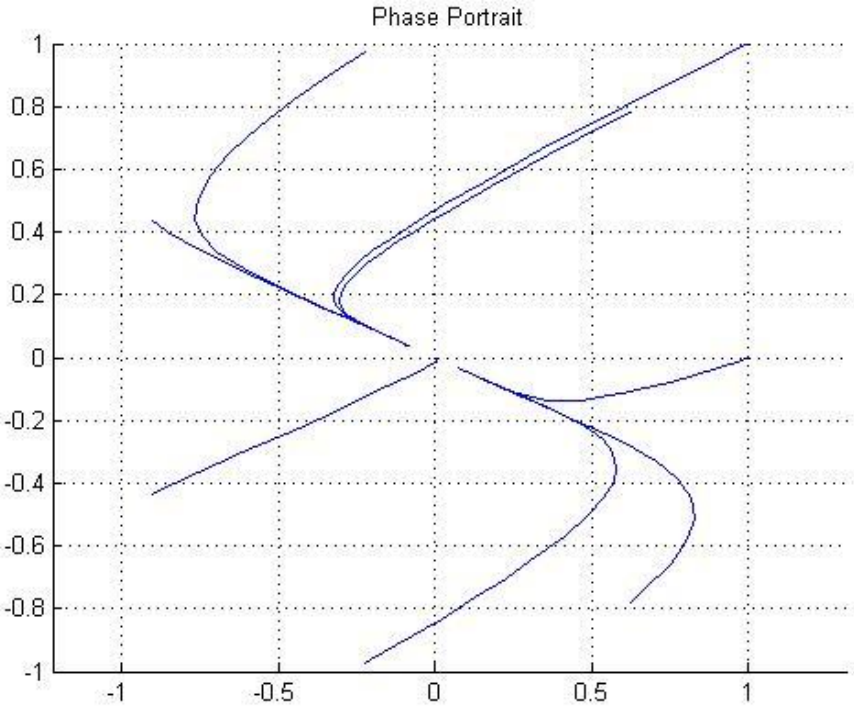
Mu = -2



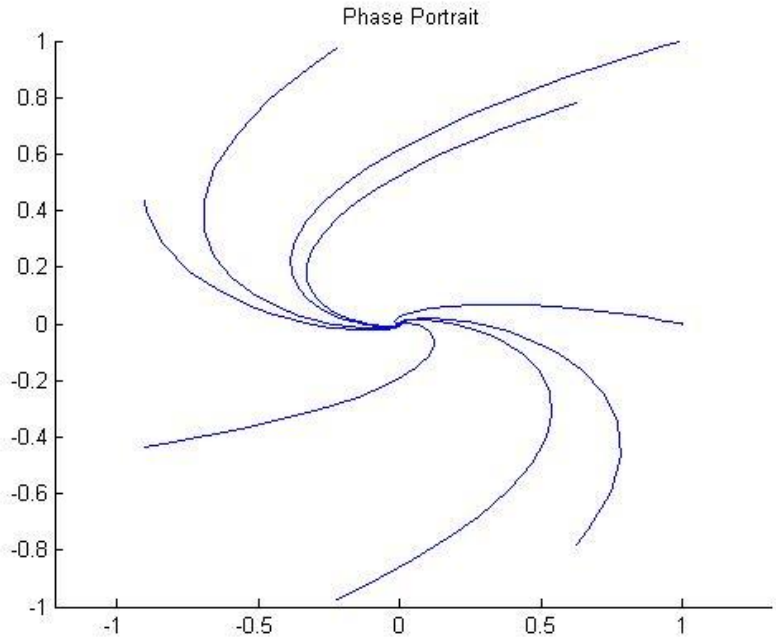
Mu = -1.75



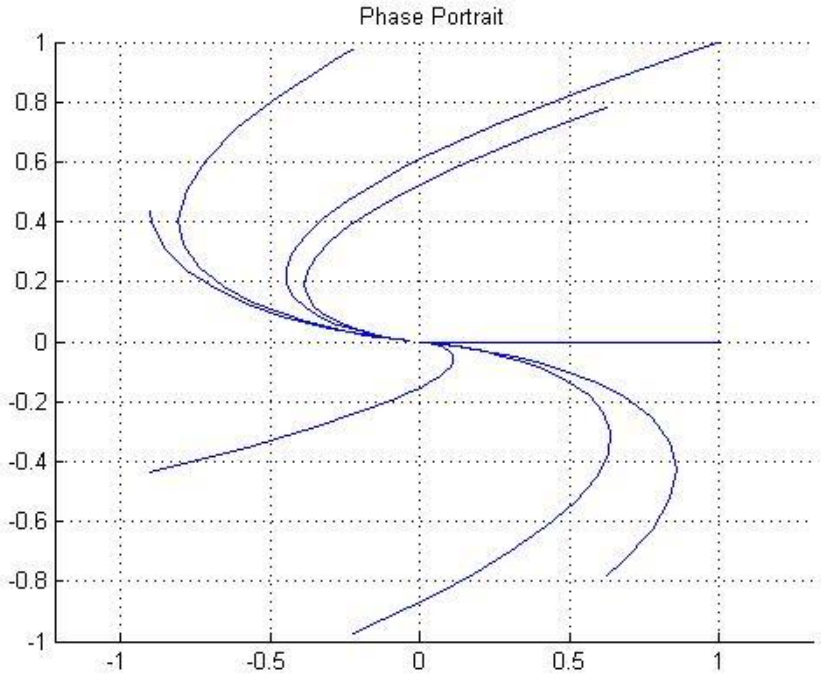
Mu = -1.5


Phase Portrait
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.5
0
0.5
1

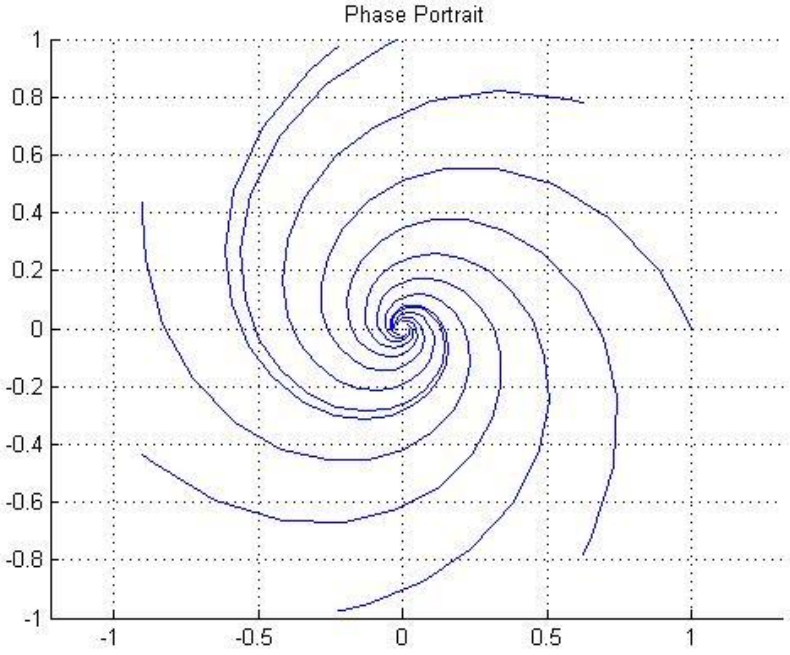
Mu = -1.25


Phase Portrait
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.5
0
0.5
1

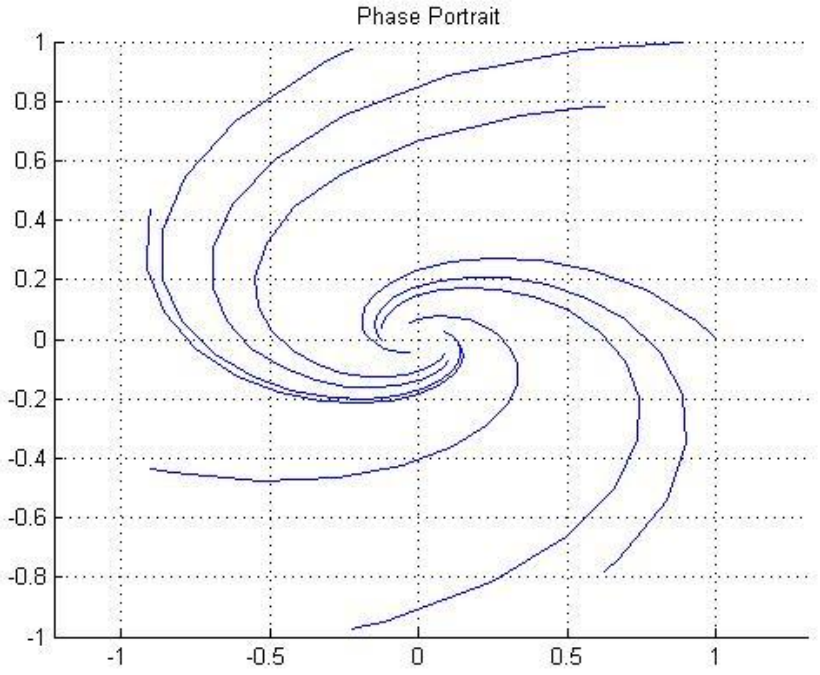
Mu = -1


Phase Portrait
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.5
0
0.5
1

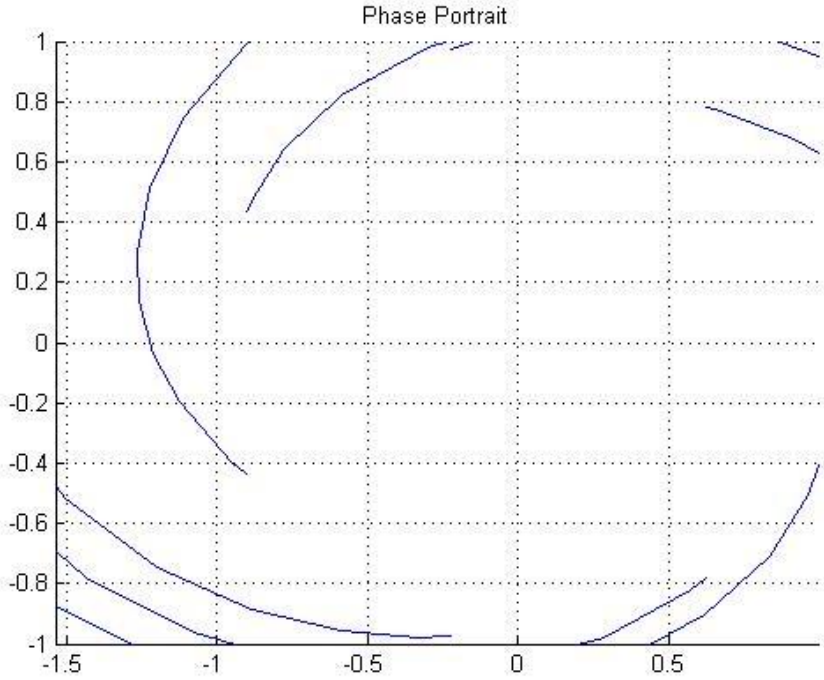
Mu = -0.75


Phase Portrait
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.5
0
0.5
1

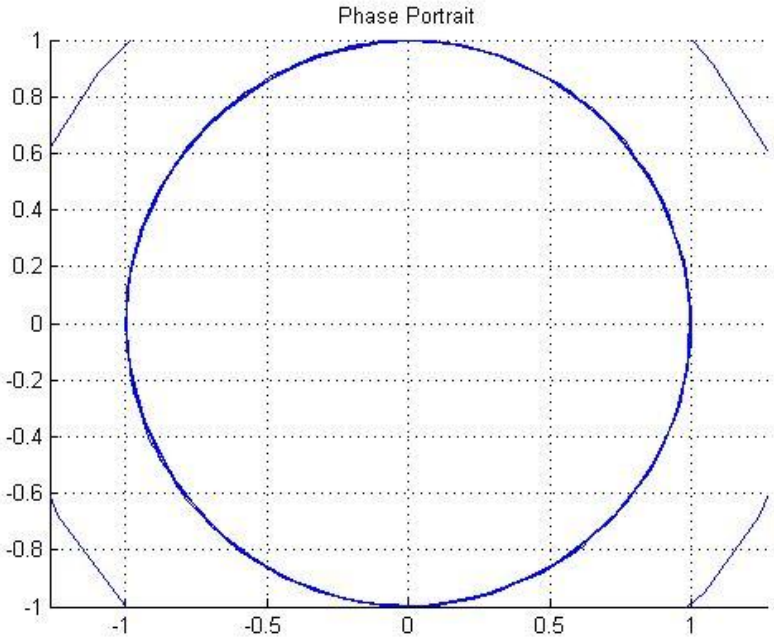
Mu = -0.5


Phase Portrait
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.5
0
0.5
1

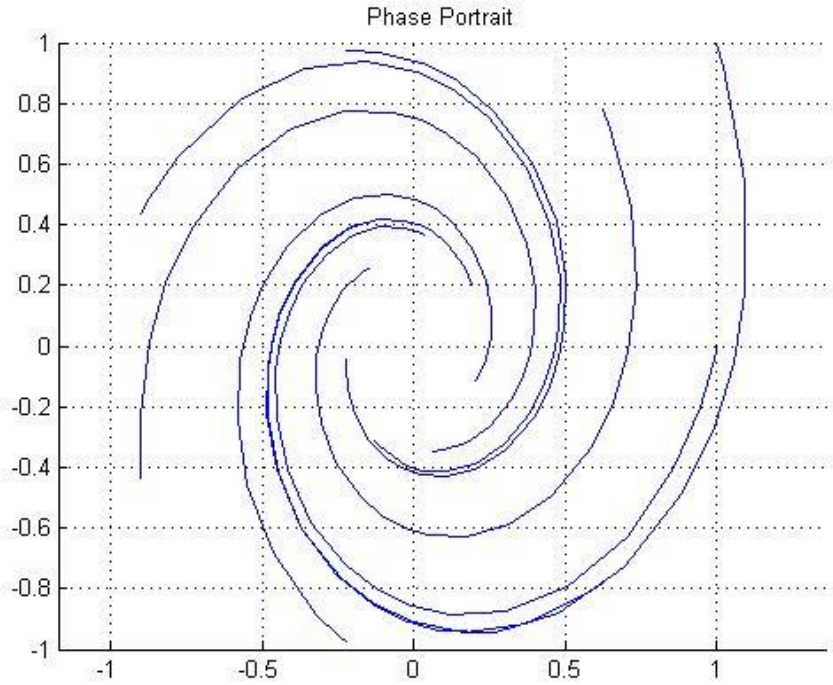
Mu = -0.25


Phase Portrait
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.5
-1
-0.5
0
0.5

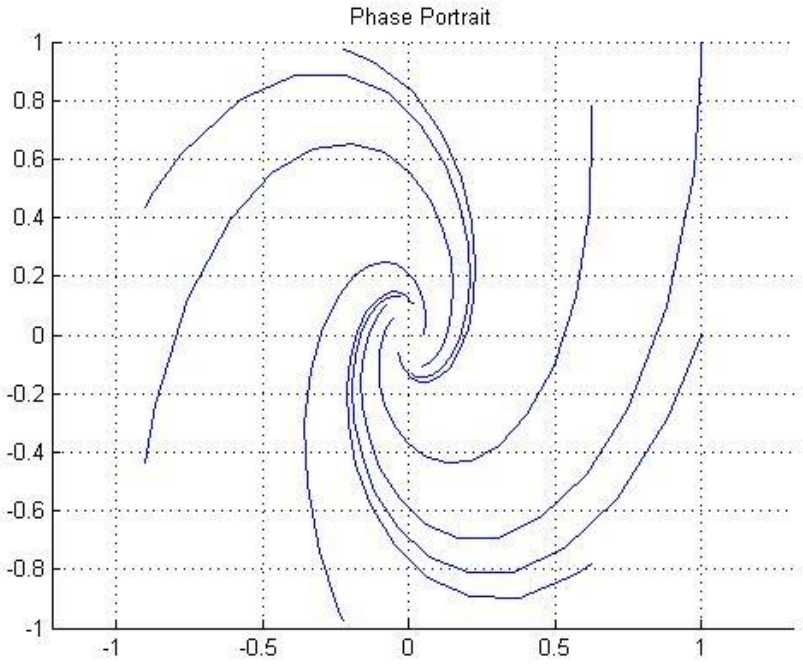
Mu = 0


Phase Portrait
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.5
0
0.5
1

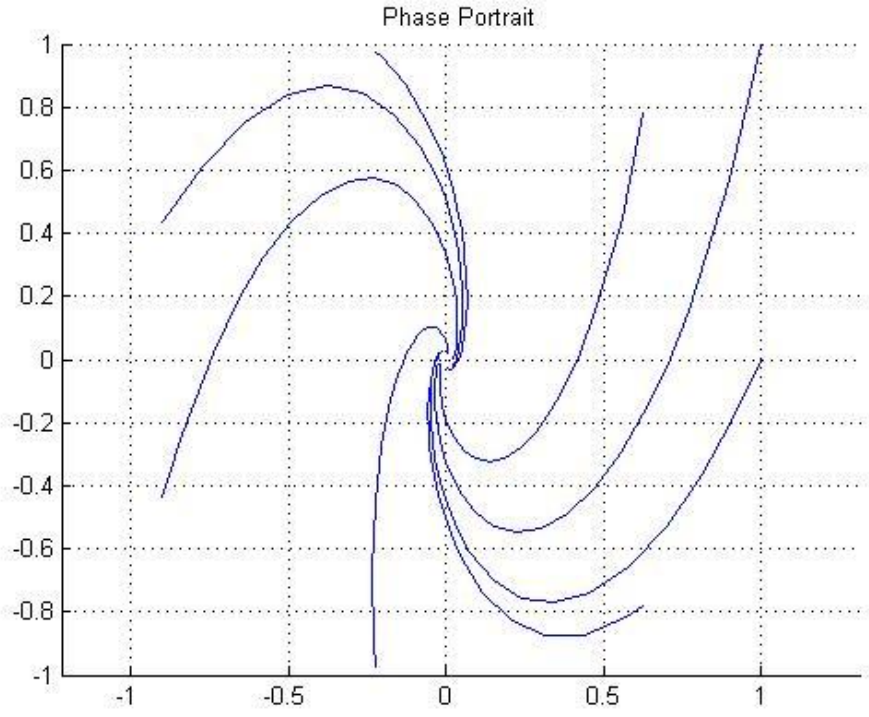
Mu = 0.25


Phase Portrait
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.5
0
0.5
1

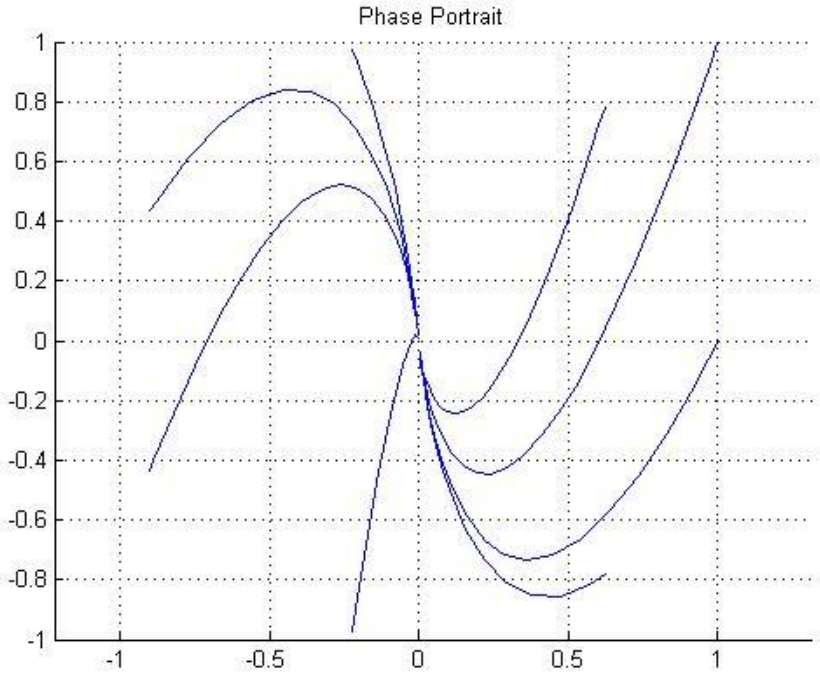
Mu = 0.5


Phase Portrait
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.5
0
0.5
1

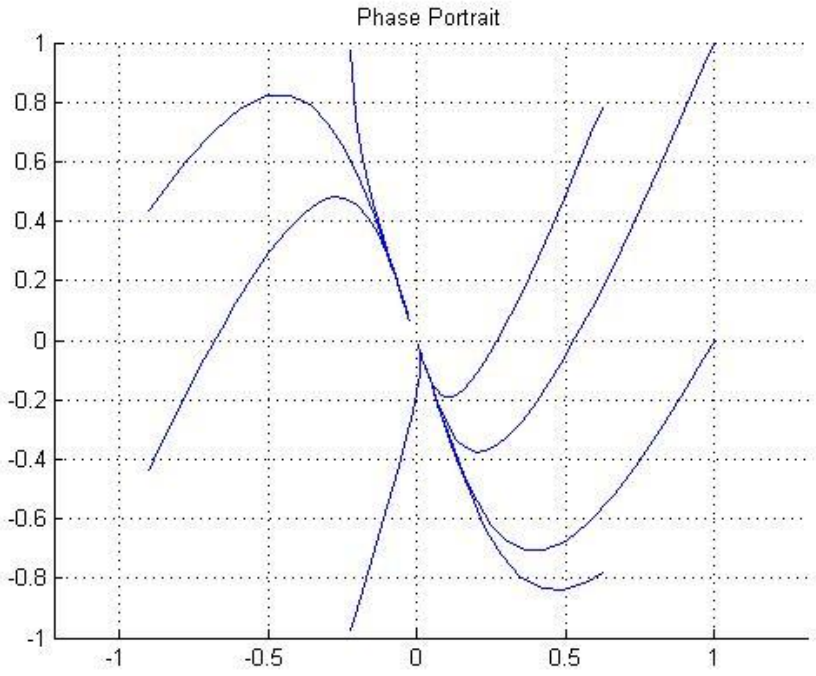
Mu = 0.75


Phase Portrait
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.5
0
0.5
1

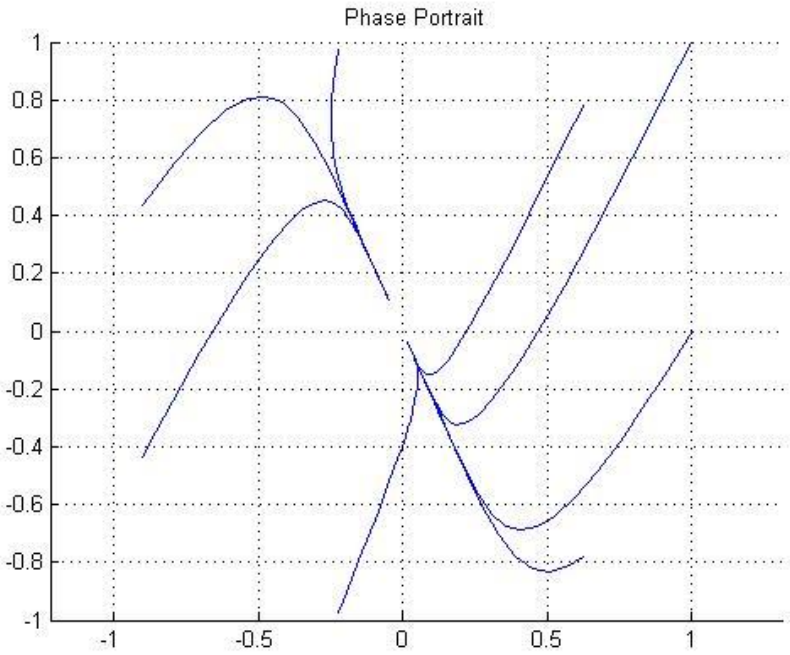
Mu = 1


Phase Portrait
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.5
0
0.5
1

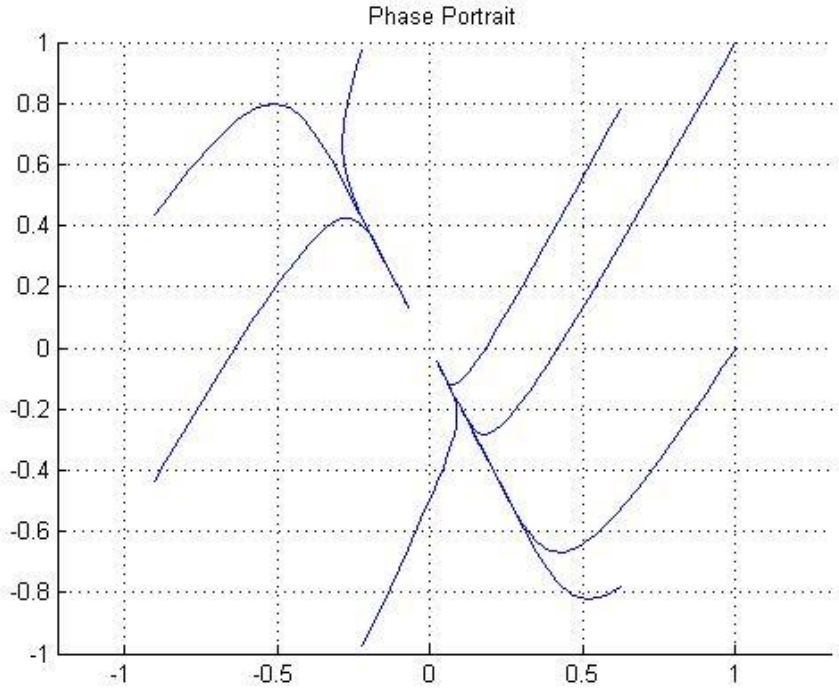
Mu = 1.25


Phase Portrait
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.5
0
0.5
1

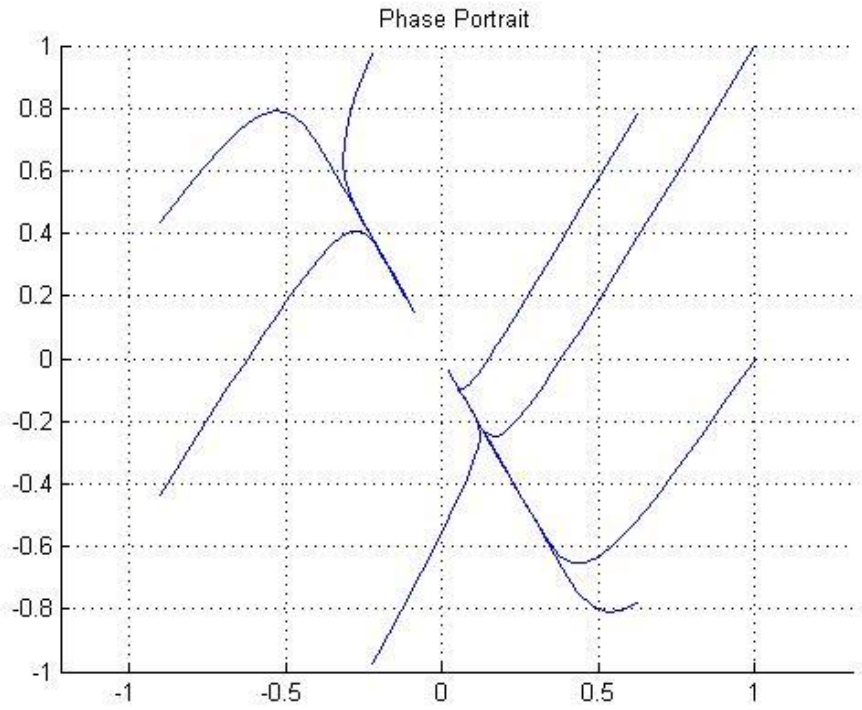
Mu = 1.5


Phase Portrait
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.5
0
0.5
1

Mu = 1.75


Phase Portrait
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.5
0
0.5
1

Mu = 2



Explanation of Graphs –

From Mu = -2 to Mu = -1.5, the graphs represent a nodal source. From Mu = -1.25 to Mu = -0.5, the graphs represent an improper node (twist). At Mu = 0, the graph represents a center. From Mu = 0.25 to Mu = 1.25, the graphs represent an improper node (twist) once again. From Mu = 1.5 to Mu = 2, the graphs represent a nodal source.