Newton and fractals

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when we look at the behaviour of newton root finding,we can see that when the starting point is far from the root then we will have problems and it may take a long time to converge (or not converge at all). Cleve Moler shows in his blog this behavior using the formula

$$x^3 - 2x - 5$$

This formula is famous because it was used to show the convergence of Newton method long time ago (Cleve uses a citation of De Morgan)

Some initialization for the figure width

```
x0=10;
y0=10;
width=500;
height=300;
```

Function to run

```
F = @(z) z.^3-2*z-5;
```

First derivative of F(x)

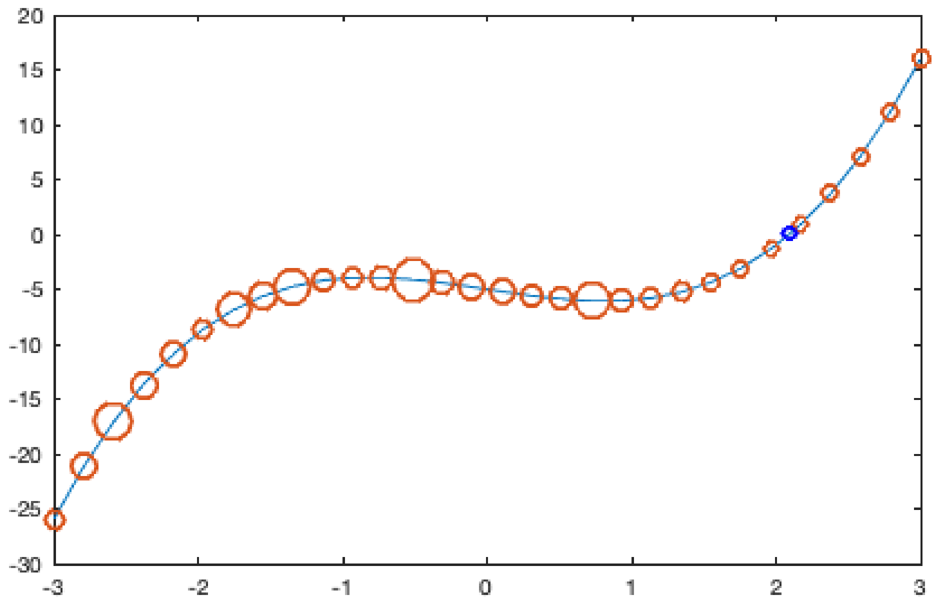
```
Fprime = @(z) 3*z.^2-2;
```

A test how Newton finds the real root with real starting numbers

with plotting of the number of iterations onto the starting point of the

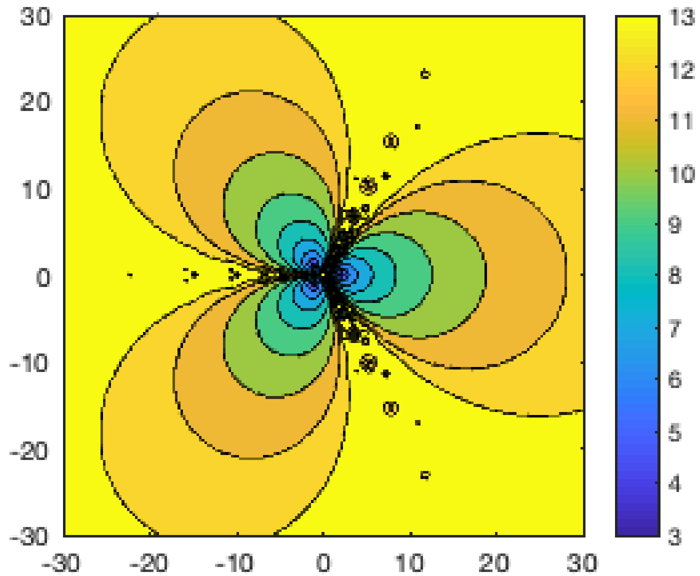
```
%root search of the function
%
n=30;
xlow=-3;
xhigh=3;
```

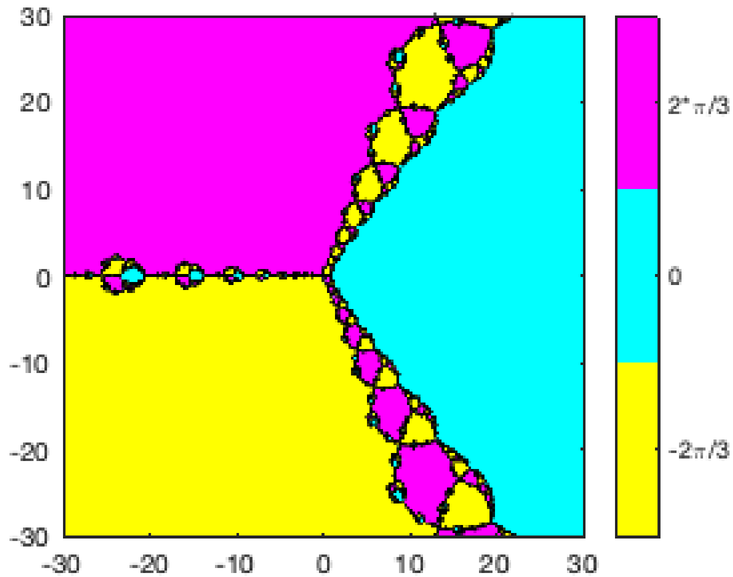
```
xs =linspace(xlow,xhigh,n);
kk=zeros(1,n);
xz=zeros(1,n);
for i=1:n
    [xz(i), kk(i)] = newton2(F, Fprime,xs(i));
end
figure(1);
% Plot of the function $x^3-2x-5$ with circles that represent the
 number
% of iteration to find the root at the blue marker.
set(gcf,'units','points','position',[x0,y0,width,height])
plot(xs,F(xs));
hold on;
scatter(xs,F(xs),10.*kk);
plot(xz(n/2),0,'bo')
hold off;
```



Exploration of fractals

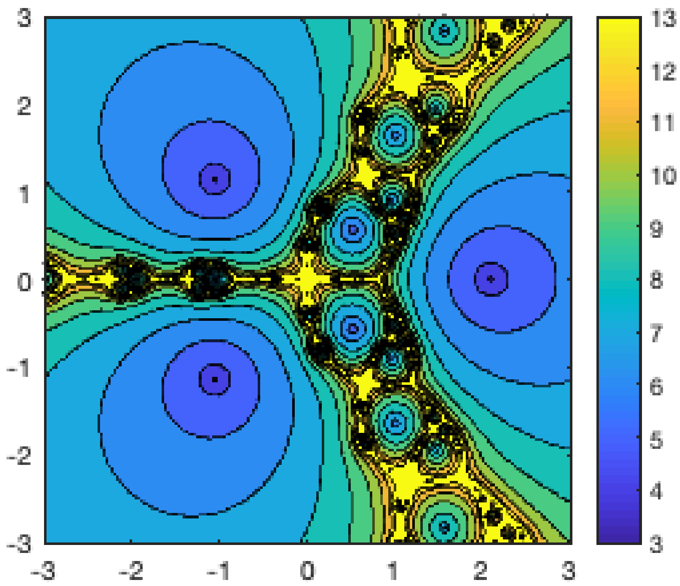
```
[zz kk] = fractals(F,Fprime,0,30,512);
```

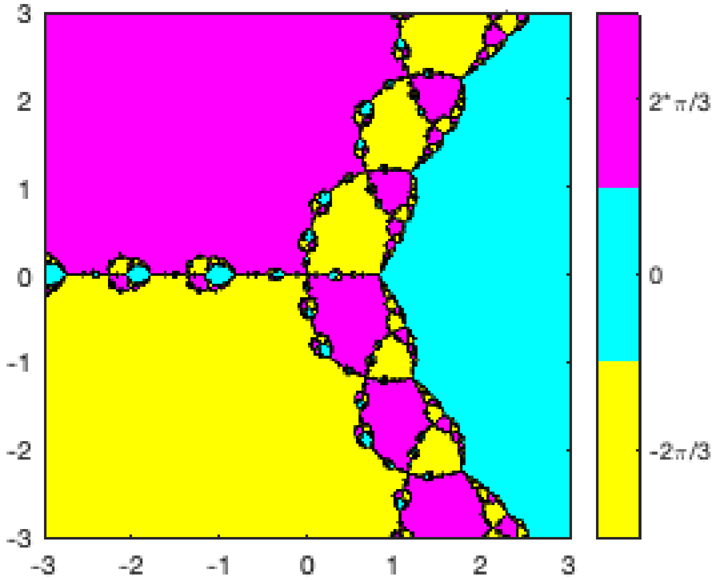

30
20
10
0
-10
-20
-30
-30 -20 -10 0 10 20 30
13
12
11
10
9
8
7
6
5
4
3


30
20
10
0
-10
-20
-30
-30 -20 -10 0 10 20 30
2*π/3
0
-2π/3

Zooming in: Exploration of fractals

```
[zz kk] = fractals(F,Fprime,0,3,512);
```





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