Matlab/Freemat/Octave/Scilab: Polynomials

A polynomial[1] can be defined in Matlab/Freemat/Octave/Scilab as a set of coefficients. In this document polynomial multiplication and division in Matlab/Freemat/Octave/Scilab is considered. Zeros (or roots) of polynomials can also be found directly in Matlab/Freemat/Octave/Scilab.

Definition of Polynomials

In Matlab/Freemat polynomials are defined as arrays of coefficients. For example the polynomial $2x^3 - 3x^2 + x - 5$ can be defined as an array in Matlab/Freemat/Octave/Scilab as follows:

```
--> poly=[2 -3 1 -5]
poly =
2 -3  1 -5
-->
```

Polynomial multiplication: conv

The product $(2x^3 - 3x^2 + x - 5)(x^2 - 2x + 3)$ can be found using the following Matlab/Freemat/Octave/Scilab code.

```
--> poly=[2 -3 1 -5]
poly =
2 -3  1 -5
--> poly2=[1 -2 3]
poly2 =
1 -2  3
--> conv(poly,poly2)
ans =
2  -7  13 -16  13 -15
```

The answer can be interpreted as $2x^5 - 7x^4 + 13x^3 - 16x^2 + 13x - 15$.

[A polynomial can be divided by another polynomial in Matlab (but not Freemat) by the deconv command.]

[1] Polynomials

Zeros or Roots of Polynomials

The zeros or roots of the polynomial can be found by the command roots().

Eg for the polynomial $x^2 - 1$

```
--> poly=[1,0,-1]
poly =
1  0 -1
--> roots(poly)
ans =
-1

 1
```

Eg for the polynomial $x^2 + 1$, with complex[2] zeros,

```
--> poly=[1,0,1]
poly =
1 0 1
--> roots(poly)
ans =
0.0000 +  1.0000i

0.0000 -  1.0000i
```

Eg for the polynomial $x^6 + 2x^5 + 3x^4 + 4x^3 + 5x^2 + 6x + 7$

```
poly=[1 2 3 4 5 6 7]
poly =
1 2 3 4 5 6 7
--> roots(poly)
ans =
-1.3079 +  0.5933i

-1.3079 -  0.5933i

0.7104 +  1.1068i

0.7104 -  1.1068i

-0.4025 +  1.3417i

 -0.4025 -  1.3417i
```

[2] Complex Numbers

Plotting zeros

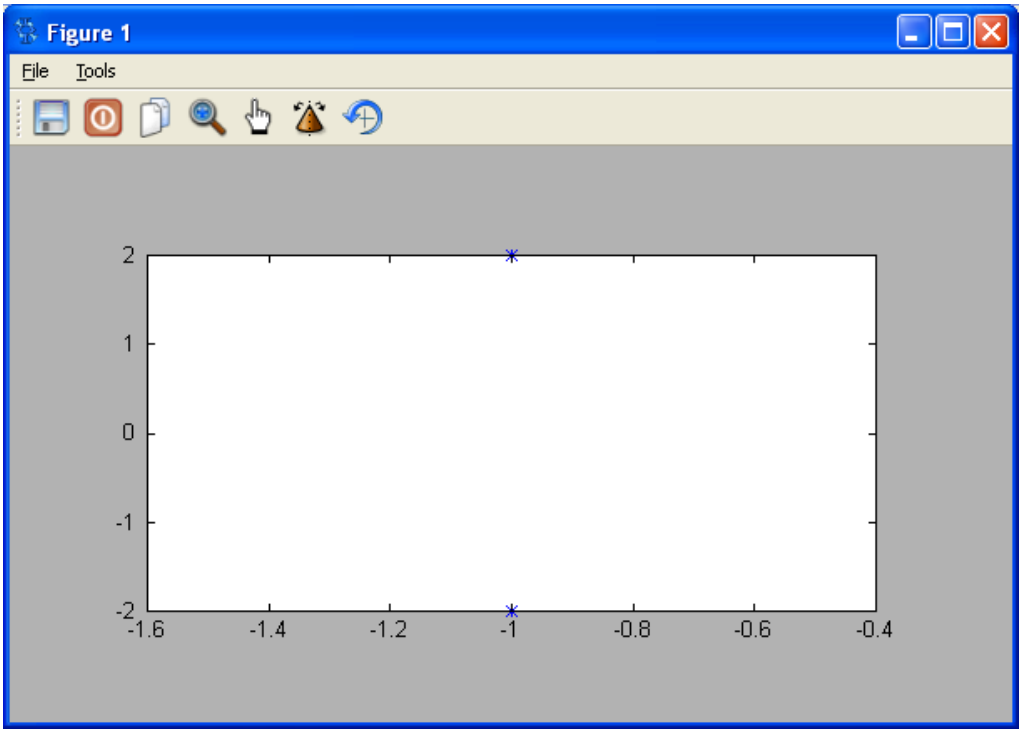
The zeros can be plotted on an Argand Diagram. For example for the quadratic[3] $x^2 + 2x + 5$.

```
--> poly=[1  2  5]
poly =
1 2 5
--> r=roots(poly)
r =
-1.0000 +  2.0000i

 -1.0000 -  2.0000i
--> x=real(r)
x =
-1

 -1
--> y=imag(r)
y =
2

-2
--> plot(x,y,'*')
```



[3] Solving Quadratic Equations