Matlab/Freemat: Complex Numbers and Arithmetic

Complex numbers[1] are fully supported in Matlab and Freemat. For complex numbers to exist, we must only allow one simple concept; that the square-root of -1 has a value, this is denotes *i* in mathematics, but it is often denoted *j* in science and engineering.

$$\sqrt{-1} = i \text{ or } j.$$

Although Matlab and Freemat automatically understand the symbols *i* and *j* to represent the unit imaginary number, but they default to using *i* (rather than *j*):

```
--> j
ans =
0.0000 +  1.0000i
--> i
ans =
0.0000 +  1.0000i
```

A complex number generally consists of a real and an imaginary part. For example $3 + 4i$ is a complex number. When declaring a complex number in Matlab or Freemat, we do not need the multiplication sign before the *i* or *j*:

```
--> 3+4*i
ans =
3.0000 +  4.0000i
--> 3+4i
ans =
3.0000 +  4.0000i
```

The complex number $3 + 4i$ has real part 3 and imaginary part 4; $\text{Re}(3 + 4i) = 3$ and $\text{Im}(3 + 4i) = 4$. The real and imaginary parts of a complex number can be found in Matlab by using the real and imag functions:

```
--> real(3+4i)
ans =
3
--> imag(3+4i)
ans =
4
```

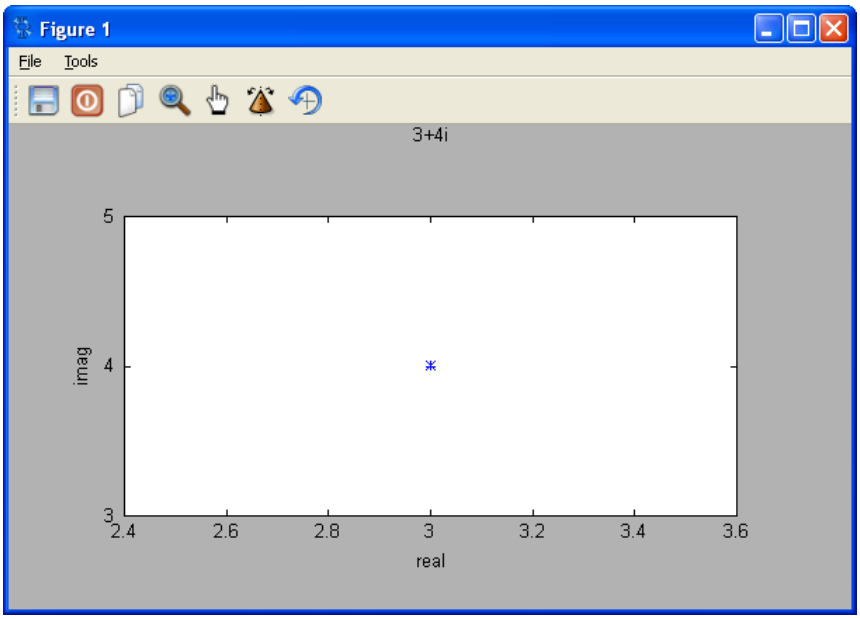
[1] Complex Numbers

Argand Diagram

Complex numbers can be plotted on an Agrand diagram in Matlab/Freemat using the following coding:

```
--> plot(real(3+4i),imag(3+4i),'*')
--> xlabel('real');
--> ylabel('imag');
--> title('3+4i');
```

In Freemat this gives the following output.



Complex Conjugate

The complex conjugate of a complex number can be obtained using the function conj.

```
--> conj(3+4i)
ans =
3.0000 -  4.0000i
```

Modulus and Argument

The modulus and argument of a complex number can be found using the functions abs and angle.

If we type the above in Matlab/FreeMat we obtain the following:

```
--> abs(3+4i)
ans =
5
--> angle(3+4i)
ans =
0.9273
```

Note that the angle is given in radians[2].

Complex Arithmetic

As for real numbers, we have the same symbols for the operations of addition, subtraction, multiplication and division in complex number arithmetic[3].

```
--> (2+5i)+(1-i)
ans =
3.0000 +  4.0000i
--> (2+5i)-(1-i)
ans =
1.0000 +  6.0000i
--> (2+5i)*(1-i)
ans =
7.0000 +  3.0000i
--> (2+5i)/(1-i)
ans =
-1.5000 +  3.5000i
```

[2] Angles
[3] Complex Arithmetic