Complex Variables Using Excel and Maple

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How to use Excel and Maple for Complex Operations

Complex Variables Course as in Fisher(1990)
Basic knowledge of Excel and Maple
Complex Arithmetic
Complex roots and polynomials
Mappings of lines, circles and squares
Series, Roots, and Integrals

Built-In Complex Operations

Using Special EXCEL commands

Excel Arithmetic

VBA Program

Maple Complex Expressions

Use evalc to carry out complex arithmetic

```
LowPass:=1/(1+I*f):
 HiPass:=I*q*f/(1+I*q*f):
BandPass:=( 1+q)/q)*LowPass*HiPass;
 BandPass:=normal(evalc(BandPass));
```

Maple to produce VBA code

Produce C code from Maple

```
 x:=evalc(Re(BandPass));
 y:=evalc(Im(BandPass));
 readlib(C):#imports the code library
 C(x);#produces C code for real part
 C(y);#copy to excel and remove ;
```

Dynamic Visualization of Roots

Maple Animation

Animated Plots of Polynomials
To animate a graph right click on the graph and select play

```
> f:=x^2-4*x+c;
> with(plots):
> animate(f, x=0..4,c=0..8);
> g:=f*x;
> animate(g, x=-2..6,c=0..8);
> animate(z^3+k*z-1,z=-4..4,k=-6..2);
```

Curves in the Complex Plane

Triangles, Circles and Squares

Maple worksheet with functions Tri, Circ and Sqr
Map exp(z), z^2 and sin(z) using functions

```
Circ:=t->exp(I*t*Pi):
h:=sin@Circ:
complexplot(h(t), t=0..3);
```

Arganbright(1993) for many maps

Poles, Laurent Series and Residues

Show poles of f:=(z+2)/(z-1)*(z-4)

```
complexplot3d(f, z=-1-I..5+I);
```

Laurent series at a pole

```
series(f, z=4,6): fp:=convert(“,
polynomial);
```

fp approximates f

```
complexplot3d(f-fp, z=-1-I..5+I);
```

Singular values and Residue

```
singular(f); residue(f, z=4);
```

Zeros of Cubics

Cyclic cube roots of unity:

```
w:=solve(z^3=1, w);
for n to 6 do
  evalc(w[2]^n);
od;
solve(w^3-12*w+20, w);
solve(z^3+z^2+a*z+a, z);
fsolve(z^3+z^2+3*z+2, z, complex);
```

Definite Integrals

```
int(x^4/(1+x^8), x=-infinity..infinity);
int(1/(2+cos(t)^2), t=0..2*Pi);
u:= cos(x)/(x^2+a^2);
int(u, x=-infinity..infinity);
Residue(u, I*a);
```

References

Fisher, S., Complex Variables, *Wadsworth*
Bloch, S., Spreadsheet Analysis for Enigneers and Scientists, *Wiley*
Arganbright D., Spreadsheet Curves, *CRC*