Demonstration of Root of Non Quadratic Equation In Complex Analysis of Higher Order Cl_ (0, n+1)

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ABSTRACT

The study of complex numbers, their derivations, manipulation, and different plats is known as complex analysis. Complex analysis is a veritably important tool that has a surprising number of practical usages in working physical problems. Complex analysis is a part of mathematics that studies functions of complex numbers. It's also known as the proposition of functions of a complex variable. numerous branches of mathematics, similar as algebraic figure, number proposition, logical combinatorics, and applied mathematics, as well as specifics, similar as hydrodynamics, thermodynamics, and especially quantum mechanics, benefit from it. Complex analysis has usages in engineering fields similar as nuclear, aerospace, mechanical, and electrical engineering by extension.

Keywords :– Complex Number, Hyperbolic Function, Circular Function, Exponential Function.

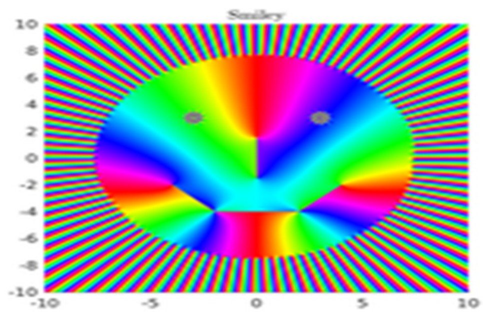
INTRODUCTION

The Wiener-Hopf Technique :-

An important part of our work in the mathematical study of swells relies heavily on deep results in Complex analysis. In particular, we've a strong experience in the so- called Wiener- Hopf method. This method is veritably important and has been really successful for working canonical problems exactly for a broad range of usages acoustics, electromagnetism, stiffness, water-swells, Stokes flows, heat equation, etc. It's traditionally associated to two- dimensional problems and involves functions of one complex variable. Then's a brief literal perspective on the method. The substance of the method consists in using the Fourier transfigure to pass from a Boundary value problem(PDE boundary conditions) in the physical space into a functional equation in the complex Fourier space. similar functional equation generally takes the form

$$K(\alpha)\Phi_{+}(\alpha)=\Phi_{-}(\alpha)+F(\alpha),$$

where K is a known(most frequently algebraic) function traditionally called the kernel and F is a known forcing that generally only contains simple poles. The two unknown functions of the problem are Φ_+ and Φ_-. It's still generally known that Φ_+ is logical in the upper- half α complex field, while Φ_- is logical in the lower- half complex field. frequently the kernel has a complicated oddity structure, involving branch points, poles, etc. One of the crucial aspect of the method is to be suitable to write $K(\alpha) = K_{+}(\alpha)\, K_{-}(\alpha)$, where K is logical in the upper half field and K_- is logical in the lower half field. This is called a factorization of the kernel. For" simple" diffraction problems involving one unlimited scatterings, both the kernel, the unknowns and the forcing are scalar functions. still when multiple scatterings are present, or when scatterings have finite length, the kernel becomes a matrix and the forcing and unknowns are vectors. In this situation, the factorization(though possible in principle) becomes much more complicated to do in practice and remains an ongoing theoretical challenge. A many other way of a analogous nature can be done involving the conception of sum- split, and the use of Liouville's theorem. The end result being an exact expression for Φ_+ and Φ_-. The physical field can be recovered directly via inverse Fourier transfigure, i.e. a typical complex outline integral. The distortion of outline integration is allowed under certain theories, and choosing the right distortion for optimal evaluation is also of veritably interesting examination content that we're involved in.



The application of such technique necessitate a very good understanding of functions of one complex variables and their possible singularities, poles, branch points, branch cuts, etc. Visualizing complex functions is not necessarily straightforward. If one is interested in the location at type of singularities of a function, a simple visualization tool, called phase portrait can be used.
On such plot, branch cuts are colour discontinuities, and poles and zeroes can also be easily distinguished. Here is an example of such visualization

Analytic Function

Since we are working with complex numbers, we will be dealing with analytic functions. Supposing $g(z)$ is an analytic function and α is in its domain, we can write

$$g^{(k)}(z) = \sum_{j=0}^{\infty} \frac{g^{(k+j)}(\alpha)}{j!}(z-\alpha)^j ,$$

k= 0,1,2…..

Polar coordinates

In the figures above we have marked the length r and polar angle θ of the vector from the origin to the point z = x + iy. These are the same polar coordinates you saw in 18.02 and 18.03. There are a number of synonyms for both r and θ.

r = |z| = magnitude = length = norm = absolute value = modulus

θ = arg(z) = argument of z = polar angle of z

As in 18.02 you should be able to visualize polar coordinates by thinking about the distance r from the origin and the angle θ with the x-axis.

Complex exponentials and polar form

Now let's turn to the relation between polar coordinates and complex exponentials. Suppose $z = x + iy$ has polar coordinates r and θ. That is, we have $x = r\cos(\theta)$ and $y = r\sin(\theta)$. Thus, we get the important relationship.

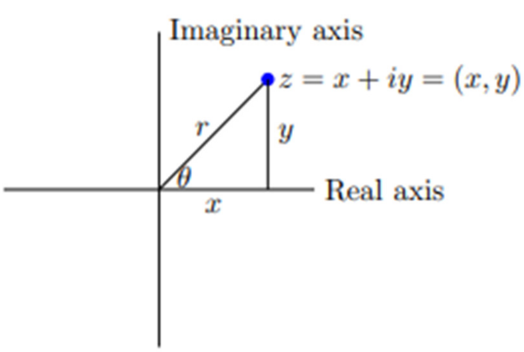
$$z = x + iy = r\cos(\theta) + ir\sin(\theta) = r(\cos(\theta) + i\sin(\theta)) = re^{i\theta}$$

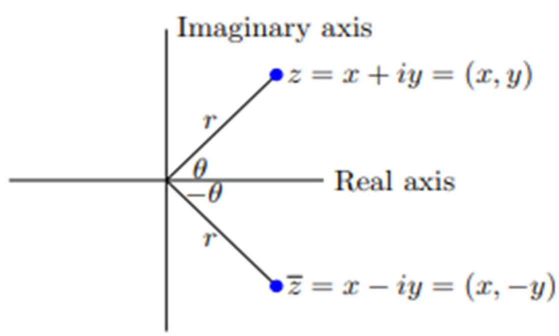
Now we can write the power series for eiθ and then split it into the power series for sine and cosine:

$$e^{i\theta} = \sum_0^\infty \frac{(i\theta)^n}{n!}$$

The geometry of complex numbers

it takes two numbers x and y to describe the complex number $z = x + iy$ we can visualize complex numbers as points in the xy-plane. When we do this we call it the complex plane. Since x is the real part of z we call the x-axis the real axis. Likewise, the y-axis is the imaginary axis.





PROBLEM STATEMENT

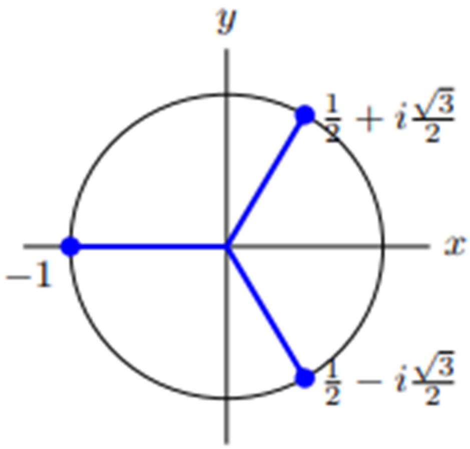
Find the 3 cube roots of -1.

Solution: $z^3 = -1 = e^{i\pi + i2\pi n}$. So, $z^n = e^{i\pi/3 + i2\pi(n/3)}$ and the 3 cube roots are $e^{i\pi/3}$, $e^{i\pi}$, $e^{i5\pi/3}$.

Since π/3 radians is 60◦ we can simplify:

$$e^{i\pi/3} = \cos(\pi/3) + i\sin(\pi/3) = \frac{1}{2} + i\frac{\sqrt{3}}{2}$$

$z^3 = -1, \frac{1}{2} \pm i\frac{\sqrt{3}}{2}$



Cube roots of -1

CONCLUSION

Complex analysis is an important part of the mathematical landscape because it connects many topics from the undergraduate curriculum. It can be used as a capstone course for mathematics majors as well as a stepping stone to independent research or graduate school study of higher mathematics. The Complex Method is a general optimization technique that can be used to solve a wide range of roots of equation of complex number problems with inequality constraints directly. Inequality constraints are a problem with this method.

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